article

ESG pillar scores, market valuation and excess stock returns - Evidence from a global dataset

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Abstract

This thesis studies the effect of ESG pillar scores (Environmental, Social, Governance) as well as ESG Total and Controversies Scores on market valuations and excess stock returns, using Refinitiv global dataset from 2002 to 2019. I find statistically significant and positive effect of high ESG Controversies Score, ESG GOV Score and ESG SOC Score on natural logarithm of Market-to-book ratio, whereas the effect of ESG Total and ENV Score are significant and negative. I construct momentum portfolios based on ESG score levels and changes, and find significant and positive abnormal returns for portfolios with long position in firms with increasing ESG Total performance and short position in firms with deteriorating performance, using Carhart four-factor model. Additionally, same results are found for ESG SOC Score, whereas abnormal returns are statistically insignificant in full sample for other scores. I find higher and statistically more significant abnormal returns in the second half of the sample period for all scores and present additional evidence on larger and more significant returns for U.S. companies compared to European peers especially during period 2011-2019. Abnormal returns are also higher for smaller companies in my sample, across all five used ESG scores.

Keywords ESG , Momentum , Value creation , Excess returns , CSR

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Tiivistelmä

Tässä pro gradu -tutkielmassa tutkin ESG-luokitusten (ympäristö, sosiaalinen, hyvä hallinto) sekä yritysten arvon ja ylituottojen välistä yhteyttä. Tutkimus sisältää analyysin erikseen kaikille Refinitivin ESG-luokille. Otos on kansainvälinen ja käsittää vuodet 2002-2019. Löydökseni osoittavat, että yrityksen arvo mitattuna logaritmisella markkina- ja kirja-arvon suhteella on keskimäärin alhaisempi yrityksillä, joilla on korkea ESG-kokonaisluokitus (ESG Total) sekä yrityksillä, joilla on korkea ympäristöluokitus (ESG ENV). Vastaavasti arvot ovat korkeampia hyvän hallinto- ja sosiaalisen luokituksen yrityksille (ESG GOV ja SOC). Portfoliot, joilla on pitkä positio ESG-kokonaisluokitustaan parantaneista yrityksissä ja lyhyt positio kokonaisluokitustaan huonontaneissa yrityksissä, tuottivat tilastollisesti merkitseviä positiivisia ylituottoja. Vastaavat portfoliot sosiaalisella luokituksella ylsivät myös ylituottoihin, kun taas muiden portfolioiden ylituotot eivät olleet tilastollisesti merkitseviä. Lisätestit osoittavat ylituottojen selittyvän pitkälti ajanjakson 2011-2019 sekä yhdysvaltalaisten osakkeiden positiivisella kehityksellä. Lisäksi ylituotot ovat suurempia otoksen pienemmillä yrityksillä.

Avainsanat ESG , Momentum , Value creation , Excess returns , CSR

September 28, 2020

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1. Introduction

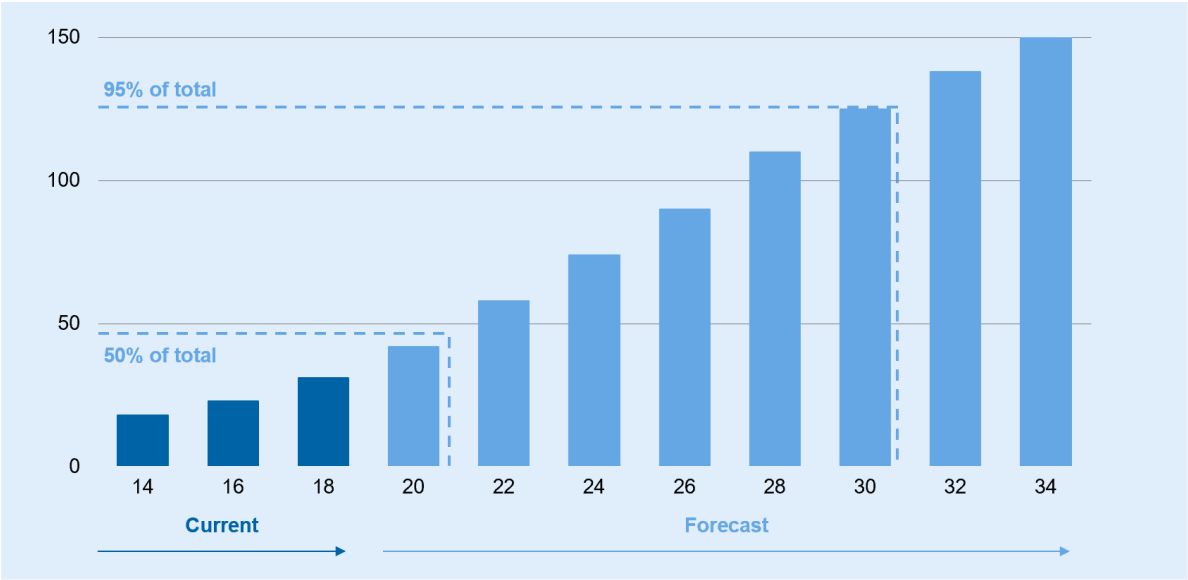
> Society gives you a license to operate. It's a question whether the society trusts you or not.
>
> - Richard Gorsky, CEO of Johnson & Johnson

Are we entering an era where other factors than financial metrics are set to drive company performance? CSR (Corporate social responsibility) and its value for shareholders has been studied by many scholars since 1970, but one could argue that responsibility topics have never before gained such attention as today. As MSCI describes, *"ESG Investing is a term that is often used synonymously with sustainable investing, socially responsible investing, mission-related investing, or screening"* (MSCI Inc., 2020), and thus ESG covers a wide range of topics within investing landscape. The letters in ESG are split to three overall themes: environmental, social and governance. In this thesis, I use Refinitiv data, where scores ESG ENV, SOC and GOV, correspond to the three pillars of ESG. Additionally, Refinitiv ESG Data includes a Total Score which is a weighted score of the three pillar scores, and a Controversies Score that measures company's involvement in ESG related controversies.

ESG investing has gained a lot of interest in the last years, as there is more demand from the clients of fund managers for sustainable investment, which can be seen both in terms of introduction of new funds with sustainable investment strategies and overall strategic goals of wealth management companies. Offering investment products that cater to investor needs in terms of responsibility is crucial, as already in 2000, a poll by Environics (1999) showed that across 25,000 individuals, corporate citizenship was the most important source of investor opinion above brand value and business fundamentals. Today, investors are willing to pay 0.7 dollars more for a stock that gives one dollar more to charity per stock, whereas companies with negative social impact were valued 0.9 dollars less per share (Bonnefon, J. F. et. al 2019, see Smith (2020)).

As of 2020, ESG ETFs present 52 billion dollars of the total 6 trillion ETF market, and demand is set to ramp up: U.S. private bank Brown Brothers Harriman (BBH) estimated that 74 % of their surveyed investors are planning to allocate more funds to ESG funds in 2020 (Smith, 2020). According to Deutsche Bank estimates, ESG mandates are estimated to have 50 % share of the global assets under management, and accounted for 30 trillion USD in 2018 (Schlaffer, Hobisch, & Cavalli, 2020). The share of ESG assets of total AUM is set to increase to 95 % by 2030 (see figure 1), according to Deutsche Bank forecast.

If ESG investing is going to be an increasing trend, asset managers need to be ready to provide investors with factor ETFs or mutual funds with more tailored approaches than just ESG Total impact.



Source: Deutsche Bank, Global Sustainable Investment Alliance, zeb research

Figure 1: Global AUM invested in ESG mandates (in USD tn)
(Schlaffer et al., 2020)

I approach the topic from two different viewpoints. First, I analyze the relationship of different ESG scores and valuation to understand better which type of activities create value, which destroy, and which are irrelevant. Valuation results provide valuable input to understand excess stock returns, and how they differ based on company's ESG score. To summarize, scope for this thesis is to answer the following research questions:

1. How do different ESG scores affect market valuation?

2. How have the valuation effects of different scores changed over time?

3. Do high ESG scoring companies outperform low scoring companies, measured by execss stock returns?

4. Do companies with improving ESG performance outperform companies with deteriorating ESG performance, measured by execss stock returns?

5. How do the ESG factor portfolio returns differ based on company size, time period and market?

Market valuation is analyzed by regressing the five different ESG Scores on the natural logarithm of Market-to-book ratio. I construct ESG Momentum factor portfolios with different sorting methods to find robust evidence of performance of ESG investing across different scores, measured by risk-adjusted excess stock returns.

I find statistically significant effect on market valuation from all five ESG scores. For ESG Total, effect in the full sample is negative, although majority of it disappears when valuation is also controlled with pillar scores. ESG Controversies Score was a positive determinant of market valuation throughout the whole sample, and presented a steady increase in coefficient values, visible in monthly regressions. I find that ESG SOC and ESG GOV are positive and statistically significant determinants of firm valuation, whereas ESG ENV has a significant and negative effect. These results hold significant value to any managers contemplating whether or not to and to which projects to engage in ESG performance improvement

ESG Factor long-short portfolios yielded significant and positive alpha for ESG Total Score and SOC Score during the full sample period. Performance improves for all portfolios in the second half of the sample (May 2011 - Dec 2019), and statistically significant, positive coefficients for alpha are found for all different scores. On average, effects are statistically more significant and larger for U.S. companies compared to Europe, and abnormal returns are higher for smaller companies in the dataset. Presented results of ESG momentum portfolios are interesting to any asset manager willing to introduce more ESG-integrated products to the market and also to any investors with a more specific ESG mission. Furthermore, statistically significant risk-adjusted returns should be interesting to any investors, regardless of whether there is an ESG mission or not.

This thesis is structured as follows: First, I present the most relevant prior literature and my contribution in Literature review and contribution. Then, I proceed to describing used data and methods in more detail in sections Data and Methodology. Results are discussed in three parts: overview of results is given in section 5.1, and valuation and portfolio returns are discussed in more detail in sections 5.2 and 5.3. Additional tests on effects of sample period, firm size and country of incorporation are presented in section Additional tests, after which I wrap up in Conclusion, limitations and implications for future research.

2. Literature review and contribution

2.1. Value of corporate social responsibility activities

Word corporate social responsibility (CSR) is often used instead of ESG in prior research on value creation. In his study on the CSR definition, Dahlsrud (2008) identifies five key dimensions of CSR: environmental, social, economic, stakeholder, and voluntariness dimensions. These are closely linked to ESG, as environmental, social and stakholder dimensions refer directly to the pillars of ESG. Economic dimension refers to a company's contribution to the economic development, whereas voluntariness describes activities that are not obligied by law.

There are multiple ways how CSR can increase competitive advantage and further shareholder value. Kiernan (2001) refers to a framework that splits the competitive advantage from CSR activities into five dimensions: stakeholder capital, customer capital, innovation capital, cost and risk reduction and human resource capital. With CSR, companies can increase their bargaining power and margins with their customers via brand value and differentiate from the competition and pursue new markets. With their shareholders, companies can increase their social "license to do business" and attract more investment. Sustainable activities can also reduce risks associated with new regulation, potential scandals and controversies, and in some cases decrease operating costs. (Kiernan, 2001) Additionally, good environmental performance can decrease costs of raising capital and therefore increase shareholder value, as Clark, Feiner, and Viehs argue (2015). They state that 90 % of the studies on cost of capital and CSR included in their review found a lower cost of capital to be correlated with high sustainability performance.

Various studies have found significant results between corporate social responsibility and firm performance. Godfrey, Merrill, and Hansen (2009) find in their event study that companies participating in CSR activities tend to suffer less from a negative event affecting stock price. CSR activities can therefore work as an insurance, as they call it. They also add that participating in CSR activities targeted to the greater public is necessary to reap such insurance benefits, since activities targeted at trading partners do not have such an effect.

Byun and Oh (2018), find a positive effect of CSR activities on shareholder value, measured by Tobin's Q. They find that CSR activities targeting the local communities explain the positive effect of CSR activities, whereas broader social activities have neither a significant nor a positive effect. Nguyen, Kecskés, and Mansi (2020) find that CSR activities combined with long-term investor ownership and CSR activities regardless of the ownership structure are positive determinants of natural logarithm of Market-to-book ratio, in an U.S. sample from 1992 to 2010. They look at CSR activities in five dimensions: overall CSR, diversity,

employee relations, community and environment. They find significant and positive effect from all these dimensions, except for environment dimension. However, when looking at excess, industry-adjusted stock returns, they find significant and negative effect from long-term investor ownership combined with overall CSR activities and community activities, whereas the other three are statistically insignificant. CSR activities as an independent determinant do not exhibit any statistically significant effect on excess stock returns. They argue that explanation for this might be the reduced risk, which affects stock returns negatively. Supportive of this hypothesis, they find significant evidence of CSR activities decreasing future volatility of excess stock returns, profitability and earnings estimates.

When looking at corporate efficiency as defined as minimizing inputs while maintaining the revenue at its current level, Xie, Nozawa, Yagi, Fujii, and Managi (2019) find interesting results depending on the disclosure of ESG information per company, using global dataset and Bloomberg ESG ratings. Companies in the first and last quartile in disclosure level had significant and negative effect in corporate efficiency from a high ESG overall score. For Environmental score, positive and significant coefficient was estimated for the third and fourth quartiles. Their results suggest that companies disclosing less than average benefit from good environmental scoring, whereas top disclosers have a significant and negative effect from high environmental scoring. For social and governance scores, authors found evidence of negative effect on corporate efficiency, regardless of the disclosure.

ESG Controversies effect and firm performance has been prior studied by Aouadi and Marsat (2018). Looking at Tobin's Q and using dummy variables with whether the company had a controversy in previous fiscal year, they find surprisingly a positive and significant coefficient, but the effect disappears when Controversies Score is interacted with total CSR score. The interaction term of lagged controversies dummy and lagged Total Score contribute a significant and positive effect. Regressing on return on equity and operating income, they in turn find significant negative coefficients from the controversies dummy and with logarithm of Market-to-book ratio, authors find a negative, but insignificant effect. Their results indicate that choice of dependent variables yields different results. I use Market-to-book ratio as my outcome variable, and thus expect similar, positive coefficients. Authors also find that valuation effects are significant for *"high-attention firms, those firms which are larger, perform better, located in countries with greater press freedom, more searched on the Internet, more followed by analysts, and have an improved corporate social reputation"* (Aouadi & Marsat, 2018).

There are also scholars arguing for the value-destroying effect of the ESG activities. From agency theory perspective, ESG-activities can be a tool for management to increase their personal capital rather than the shareholder value. For instance, (Benabou and Tirole 2010; Kitzmueller and Shimshack 2012, see Serafeim (2020), p. 8), argue that ESG-related

spend is wasting company resources as it allows managers to promote their reputation within their respective companies but also in larger society. From a social perspective, agency problems can generate from managers trying to buy employee support and avoid replacement by adopting more employee-friendly workplace practices to avoid replacement (Cespa and Cestone 2007, see Serafeim (2020), p. 8).

In the light of mixed results, Margolis, Elfenbein, and Walsh (2007) conduct a meta-analysis of 167 different studies on corporate financial performance and social responsibility. The overall effect in their analysis is positive but small. They find strongest positive link between financial performance and charitable contributions, honestly communicated and revealed misdeeds and environmental performance (Margolis et al., 2007). Another meta-analysis suggests similar results. Friede, Busch, and Bassen (2015) find from 2200 individual studies that 90 % of the results reported are non-negative, and majority are positive. They also note that the results are stable over time, with analyzed studies dating back to 1970s. Overall, I hypothesize positive effect of ESG Total Score on valuations, and since ESG Total is a weighted score of the three pillars, it is logical to assume positive coefficients also for them.

2.2. ESG Momentum

Prior to this thesis, there have been only a few papers focusing on momentum phenomenon and ESG. Nagy, Kassam, and Lee (2016) studied ESG Tilt and Momentum strategies, and found overperformance compared to the MSCI world index, by ranking companies based on the improvement of ESG rating in latest fiscal year. The data in the paper was based on the global universe of MSCI index companies and MSCI ESG ratings. Their momentum strategy outperformed MSCI world index annually by 2.2 percentage points, but neither tests of statistical significance nor risk-factor regression statistics are presented in the paper. They note that ESG Momentum strategy has exposure to various common factors and investment styles, but majority of the overperformance is based on the stock-specific returns, suggesting a hypothesis of alpha existing in ESG Momentum.

Another paper, *Establishing ESG as risk premia* by Pollard, Sherwood, and Klobus (2018) argue superior risk-adjusted returns, also implementing MSCI ESG ratings data. They find cumulative alpha between 3.7 and 17.4 percent over the sample period of 2006-2016, depending on the portfolio construction method. They claim that the overperformance against randomly picked benchmark portfolio is because of the independent risk premium of ESG on top of Carhart model risk factors, although no tables from four-factor models are presented. Methodology is closer to a case study, as they randomly pick 3 portfolios of 30 stocks and compare it to a randomly picked benchmark from the same stock pool.

There is also evidence of negative abnormal returns from ESG portfolios. Nguyen et al.

(2020) construct momentum factor portfolios for different CSR activity categories from stocks having long-term investor ownership, and find significant and negative alpha for overall CSR activities and environment activities. Based on prior literature, it is also possible that CSR performance does not have an effect on excess stock returns. Halbritter and Dorfleitner (2015) find in their paper that abnormal returns are not consistent over time and over ESG rating agencies (Asset4, Bloomberg and KLD). Authors find significant effects for category scores for specific timelines, but the only score to deliver significant positive abnormal returns across the full sample of 2002-2012 is the old Asset4 Social score. In their meta-analysis of socially responsible investing profits from more than 250 studies and experiments, Revelli and Viviani find that Social responsibility is not necessarily a strength, nor a weakness for portfolio performance (2015).

The most relevant prior study for the purposes of this thesis is the paper *Public Sentiment and the Price of Corporate Sustainability* by Serafeim (2020). Serafeim's working paper is based on MSCI data, and with a robust methodology, provides a backbone for my thesis. Serafeim introduces a strategy where ESG momentum is combined with public sentiment momentum. Public sentiment momentum refers to the change in the general optimism or pessimism related to a specific stock. The data for this sentiment is acquired from big data based on multiple sources (e.g. NGOs, industry experts, analysts, think tanks and reputable media).

The author finds that an ESG factor having a long position on firms with high level or increasing sustainability performance and negative sentiment momentum and short position on firms with a low level or decreasing sustainability performance and positive sentiment momentum delivers statistically significant abnormal returns. This ESG factor is also uncorrelated with other Carhart four-factor model factors. In comparison, the high sentiment version of the ESG factor delivers only statistically insignificant alpha and is negatively correlated with the value factor. (Serafeim, 2020)

Since public sentiment is not within the scope of my study, the most relevant result from Serafeim is whether ESG momentum portfolios yield superior results regardless of the sentiment. Author also runs regression on ESG momentum including companies both with positive and negative sentiment momentum and finds a statistically significant alpha in four-factor model regression. Methods used in this thesis are derived from Serafeim, and hence I expect my results to be in line with his. Author defines ESG Factor portfolios with five different approaches (see table 8) to account for both ESG level and change and thus having the most extensive approach to follow. I expect positive alpha for ESG Total and Controversies Score portfolios, but I do not make separate hypotheses for pillar scores with the lack of fully comparable prior studies and mixed results from papers studying ESG dimensions and market valuations.

2.3. Contribution of the thesis

Prior literature on ESG value creation and momentum has focused on the overall ESG scores, not the environmental, social or governance pillar scores (Nagy et al. (2016), Pollard et al. (2018), Serafeim (2020)). On top of introducing new findings on pillar scores and Controversies Score to the existing literature, I take new approaches to how stocks are sorted to long and short portfolios, which also checks the robustness of prior literature on ESG Total Scores. Many prior studies on overall ESG momentum have lacked a robust methodology (Nagy et al. (2016), Pollard et al. (2018)), hence the results on ESG Total Score momentum are relevant and also provide valuable additional evidence.

To my knowledge, this is the first paper that studiest the effect of all ESG Total, ESG Controversies Scores and pillar scores in terms of both market valuation and excess returns from ESG Factor portfolios. To summarize key differences to the key reference paper from Serafeim, I apply the same methodology and structure, with three key contributions on top of his work. First and most importantly, I replicate the same study for ESG Controversies and pillar scores, whereas Serafeim only looks at ESG Total Score. Second, I use a Refinitiv global dataset between 2002-2019, while Serafeim's focus is in analysis of U.S. MSCI dataset between 2009 and 2018. Third, I provide new evidence on the excess return differences between different sample periods and markets, reported in section 6. All these identified gaps in current literature combined with the expected fast increase in ESG investing are the motivation for this thesis.

3. Data

ESG and firm data used in this thesis is extracted from Eikon Datastream. ESG ratings are provided by Refinitiv, and according to Refinitiv ESG scoring methodology documentation, Refinitiv ESG ratings cover up to 70 percent of the global equity market capitalization. Refinitiv ratings dataset includes to date 3500 U.S., 2100 European, 1250 Asian (excluding Japan), 600 Oceanian, 450 Japanese, 350 Latin American and 300 African and Middle Eastern companies. The measures are gathered and calculated manually for each company within the ESG universe, and ESG reported data per company is updated once a year in line with companies' own ESG disclosure. Although one company gets an update to score usually once in a year, updates to dataset are made on a weekly basis, and thus investment strategies presented in this thesis are also possible to replicate in real life. (Refinitiv, 2020a)

The ESG Scores from Refinitiv measure a company's relative ESG performance, commitment and effectiveness across 10 main themes (see Figure 2 on page 18) based on company-reported information. These theme performance measures are based on over 400 different metrics, and are used to calculate the three pillar scores. As an example, Environmental pillar score (ESG ENV) comes from themes Resource use, Emissions and Innovation (Figure 2). The three pillar scores (E,S and G) are then weighted for company ESG Total Score.

Refinitiv's ESG scoring system includes industry adjustments for ESG ENV and SOC, and country adjustments for ESG GOV. Since different aspects of ESG have different materiality to companies based on the business they operate, Refinitiv has different weights on the categories within ENV and SOC pillar scores depending on the industry. Furthermore, GOV pillar score has same category weights across all industries, but is adjusted based on the country of operation to reflect governance performance relative to the country norm. Additionally, weighting of the three pillar scores to calculate Total Score varies across industries. Score for individual company in a given category is an index score between 0 and 100, based on its performance compared to the industry peers. The index is given by formula 1. Finally, a transparency weighting adjustment is used to punish companies not disclosing material information on ESG performance. Transparency weighting also means that reported, but less important metrics do not influence the overall category rating to high extent.

ESG Controversies variable rates a company's performance with 23 different controversy topics. Refinitiv aims to capture any negative publicity from different media materials to extend the ESG assessment beyond reported metrics to also take public view into account. Due to more extensive media coverage on larger companies, Refinitiv adjusts the

Controversies Score based on company size by weighing a controversy with a factor of 1 for small cap company, by 0.66 for mid cap and 0.33 for a large cap company. Although ESG Controversies Score is also updated as often as other ESG scores, controversies from previous fiscal years also affect the following years' scores, if they are still relevant to the company's reputation. ESG Controversies Score is also rated on a scale between 0 and 100. Difference to category score is that with no controversies, score is 100 and the rest are rated based on the size-adjusted number of controversies (see formula 2).

$$\text{ESG category score} = \frac{\text{number of companies with worse value} + \frac{\text{number of companies with current value}}{2}}{\text{number of companies in benchmark group}} \quad (1)$$

$$\text{ESG Controversies Score} = \frac{\text{number of companies with worse value} + \frac{\text{number of companies with current value}}{2}}{\text{number of companies with at least 1 controversy in benchmark group}} \quad (2)$$

As presented in Figure 2, ESG Total Score is combined with ESG Controversies Score for ESG Combined score. Combined score is same as the ESG Total Score, if ESG Controversies Score value is higher than ESG Total Score. If Controversies Score is smaller, Combined score is the average of the two. For the purposes of this paper, I look at both of these variables separately, and leave Combined score out of the analysis.

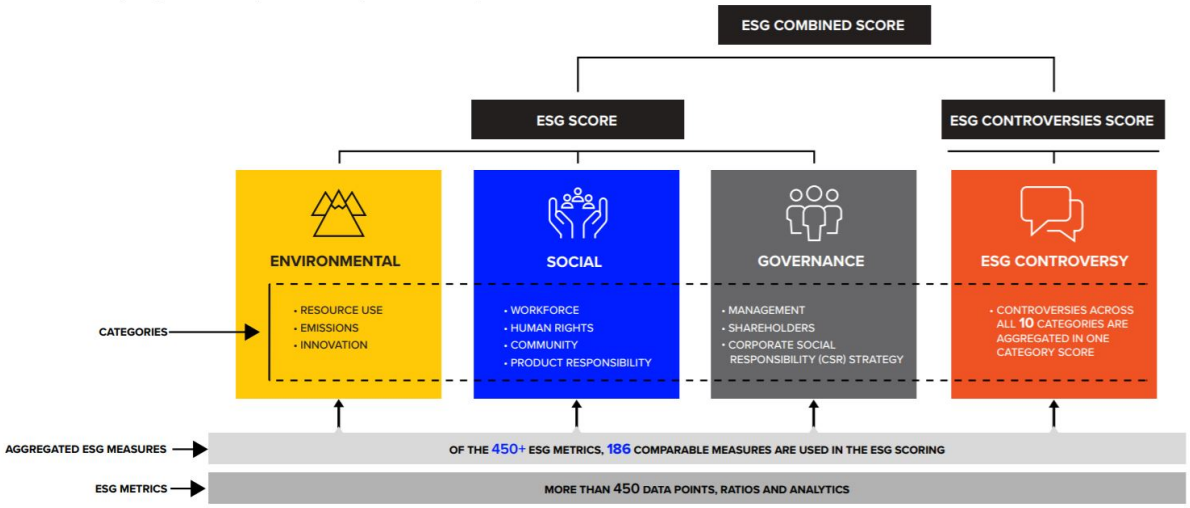


Figure 2: Refinitiv ESG Scoring methodology
(Refinitiv, 2020a)

Refinitiv has changed its variable definitions through time, and ESG pillar scores did not exist in the same exact form through the whole sample. Prior current ESG pillar and Controversies Scores, Asset4 ESG ratings (Precedent of Refinitiv ESG Data) had the following scores: Overall Equal weighted rating score (corresponds to ESG Total),

Corporate Governance score (corresponds to ESG GOV), Economic Score, Environmental score (corresponds to ESG ENV) and Social score (corresponds to ESG SOC). New scores were introduced in 2018: pillar score methodologies were redefined, ESG Controversies Score was added as a new variable and Economic Score dropped. This means that ESG Controversies portfolio could not have been constructed at the time as the ratings have been calculated and traced back afterwards, but my results still shed light on the valuation and excess returns in relation to ESG scandals. From Refinitiv's materials it is unclear whether Total and pillar scores prior 2018 have been recalculated with new methodology, but I assume that even in this scenario, results and implications would be similar. Ultimately, I assume that top performers are the same with both Asset4 and Refinitiv scoring methodologies on average. To add, in April 2020 Refinitiv updated their methodologies once more (Refinitiv, 2020b) to penalize companies not disclosing pillar score information. The new methodology provides environmental and social pillar scores of zero for companies which do not provide enough disclosure of data, even though previously these companies had score greater than zero. However, as I downloaded my data in late 2019, most recent update does not affect my sample. This is still important to bear in mind when comparing research on Refinitiv data to my results in the future.

Refinitiv can make changes to a score for up to 5 years after a score release if there are for instance any important company restatements concerning ESG data. Although I assume that these cases are quite marginal, it means that for a specific company, ESG score given in dataset might not have been available with the same value when it was originally released. Even with all these inconsistencies in Refinitiv ESG Data, it is still relatively safe to assume that current dataset still gives an objective and realistic view of which companies were viewed as top and bottom ESG performers at that historic point of time based on ratings.

Sample period is from August 2002 to December 2019. Same period is used for Market-to-book full sample regressions, as well as Factor portfolio regressions. I exclude 2019 in monthly Market-to-book regression coefficient analysis, since sample size for 2019 was still small at the time of download and created potential biases into time-variation analysis. On total level, exclusion was not needed as time variation is controlled with year-month fixed effects. For Factor portfolios exclusion of 2019 is not made, since same ESG change and level variables are copied for the following 12 months after update.

Refinitiv ESG Rating data is combined with relevant financial information and divided into two different subsets based on purpose: Market-to-book regressions and ESG Factor regressions. No potential outliers in control variables are removed from the sample. Market-to-book dataset has a slightly smaller sample size due to data loss from rows of missing financial variables. There are in total 6014 unique firms in my Market-to-book dataset, whereas my Factor dataset has 6244 unique firms. As the difference is only 230

firms, datasets can be considered homogeneous compared to each other and comparisons between results are feasible. Additionally, in Factor regressions previous score value is maintained for a company for next 12 months in the case of dropped coverage, which also adds up to the size difference between the two subsets. Monthly number of stocks in different ESG Factor portfolios are reported in appendix A in tables 46, 47, 48, 49 and 50. Summary statistics for both datasets are presented in Table 1 and Table 2. Definitions of financial control variables are found in these tables.

Tables 3, 4, 5 and 6 exhibit the country distribution in Market-to-book sample across years 2003, 2008, 2013 and 2018. Developed countries are heavily weighted in the sample, especially in the years between 2003 to 2008. At the end of 2003, dataset comprises of virtually only developed country stocks, with U.S., Japan and Great Britain holding a combined share of 67 % and rest covered by largely other European countries. From 2008 onwards, dataset gets more exposure to emerging markets: MSCI World index companies were added in 2008 and MSCI Emerging markets constituents in 2011. Latin American stock index constituents were added between 2012 and 2017 and U.S. sample is further increased by inclusion of Russell 2000 and 3000 index companies in 2017. Later in 2018, 179 new Chinese companies are added to the dataset.

Key trend is that U.S.'s and Japan's relative importance decreases 2008-2013, and European countries are replaced by Asian countries in the top 10. Combined share of Taiwan, South Africa, China, Korea, Hong Kong, Brazil and Singapore is around 20 %, whereas same countries held a share of 9 % in 2008. In 2018, relative importance of U.S. is again increased due to addition of Russell indices in 2017. Previously mentioned emerging markets hold a total share of 15 % in 2018. European countries had a share of 40% at the end of 2003, whereas it has dropped to 25% by 2019. Overall, both valuation and excess stock return results in this paper are driven by developed countries. U.S. has a significant relative influence especially between 2003-2008 and 2017 onward, Japan through 2003-2013, and Europe with a significant but decreasing influence through the whole period. Canada and Australia have a relatively high share of the sample especially between 2008 and 2013. Due to use of largest stock indices, large cap companies dominate the sample through the whole period. Average market cap in sample is 11.6 bn USD (see table 2).

Table 1: Market-to-book regression variable summary

This table presents the summary statistics of the ESG ratings and control variables used in Market-to-book regressions. Leverage denotes the ratio of Total Debt to Common Equity, Log MKT Cap previous month close the natural logarithm of the previous month closing Market capitalization in USD, Log MTB the natural logarithm of Market-to-book ratio, Past return the stock return over last 6 months, Sales growth the 1-year growth in revenues and ROE the return on Equity.

Statistic	N	Mean	St. Dev.	Min	Max
ESG Total Score	478,836	51.47	17.69	0.00	97.66
ESG Controversies Score	478,836	49.64	20.14	0.00	87.50
ESG GOV	478,766	51.11	30.66	0.95	98.23
ESG ENV	478,836	53.64	31.64	8.15	97.46
ESG SOC	478,836	53.31	30.98	3.54	99.35
Leverage	478,836	1.14	7.20	0.00	1,383.99
Log MKT Cap previous month close	478,836	8.27	1.42	−0.26	13.91
Log MTB	478,836	0.75	0.84	−4.61	8.64
Past return	478,836	0.07	0.32	−1.00	41.00
Sales growth	478,836	0.84	71.23	−1.00	12,739.00
ROE	478,836	0.13	1.65	−248.50	104.00

Table 2: Factor regression variable summary

This table presents the summary statistics of the variables used in creating the ESG Factor portfolios. "Trailing" denotes a 1-month lag and the assignment of same ESG Score one year after latest update in the case of ended screening of a specific company in dataset. "Change" denotes the absolute change in the ESG rating, which is kept at the same value until updated score. Total HPR is the 1-month holding period return including price change, dividends and stock repurchases.

Statistic	N	Mean	St. Dev.	Min	Max
ESG Score trailing	623,373	51.950	17.818	5.060	97.660
ESG Controversies Score trailing	623,373	48.999	20.685	0.080	80.000
ESG GOV trailing	623,373	52.241	30.169	0.950	98.240
ESG ENV trailing	623,373	53.065	31.904	8.120	97.460
ESG SOC trailing	623,373	53.341	30.883	3.540	99.350
ESG Total change	623,373	1.450	6.764	−74.030	64.650
ESG Controversies change	623,373	−1.361	21.601	−70.740	76.190
ESG GOV change	623,373	1.999	12.703	−82.210	83.550
ESG ENV change	623,373	2.739	11.734	−81.140	83.770
ESG SOC change	623,373	2.713	11.744	−87.230	88.330
Total HPR	623,373	0.009	0.119	−1.000	40.551
MKT Cap prev month close	623,373	11,591.640	28,038.710	0.020	1,099,435.000

Table 3: Unique firms in Data as of 31th Dec 2003

Total number of Unique firms: 695

Country	N	%
US	235	33.81%
JP	148	21.29%
GB	78	11.22%
FR	32	4.60%
DE	27	3.88%
CH	24	3.45%
SE	24	3.45%
NL	15	2.16%
IT	13	1.87%
DK	12	1.73%
ES	10	1.44%
FI	10	1.44%
BE	8	1.15%
BM	8	1.15%
CA	7	1.01%
IE	7	1.01%
AT	6	0.86%
GR	6	0.86%
NO	6	0.86%
AU	4	0.58%
HK	4	0.58%
JE	3	0.43%
AN	1	0.14%
BR	1	0.14%
IL	1	0.14%
MX	1	0.14%
PA	1	0.14%
PT	1	0.14%
RU	1	0.14%
TW	1	0.14%

Table 4: Unique firms in Data as of 31th Dec 2008

Total number of Unique firms: 1874

Country	N	%
US	509	27.161%
JP	312	16.649%
GB	173	9.232%
CA	109	5.816%
FR	69	3.682%
DE	60	3.202%
AU	56	2.988%
SE	39	2.081%
CH	37	1.974%
HK	33	1.761%
TW	31	1.654%
BM	30	1.601%
SG	30	1.601%
ES	23	1.227%
IN	23	1.227%
NL	23	1.227%
IT	22	1.174%
CN	20	1.067%
FI	19	1.014%
IE	19	1.014%
RU	18	0.961%
BE	16	0.854%
DK	16	0.854%
KR	14	0.747%
BR	13	0.694%
NO	13	0.694%
CL	12	0.640%
AT	11	0.587%
GR	11	0.587%
KY	11	0.587%
ZA	10	0.534%
MX	9	0.480%
NZ	9	0.480%
MY	8	0.427%
TR	8	0.427%
PT	7	0.374%
CO	5	0.267%
SA	5	0.267%
JE	4	0.213%
PL	4	0.213%
TH	4	0.213%
ID	3	0.160%
IL	3	0.160%
LU	3	0.160%
AE	2	0.107%
CZ	2	0.107%
PA	2	0.107%
PE	2	0.107%
AN	1	0.053%
EG	1	0.053%
HU	1	0.053%
KW	1	0.053%
LR	1	0.053%
MA	1	0.053%
MH	1	0.053%
MU	1	0.053%
PG	1	0.053%
PH	1	0.053%
QA	1	0.053%
VG	1	0.053%

Table 5: Unique firms in Data as of 31th Dec 2013

Total number of Unique firms: 3007

Country	N	%
US	639	21.250%
JP	356	11.839%
GB	217	7.216%
AU	215	7.150%
CA	155	5.155%
TW	104	3.459%
ZA	96	3.193%
CN	87	2.893%
FR	77	2.561%
IN	74	2.461%
KR	73	2.428%
DE	70	2.328%
BR	61	2.029%
KY	57	1.896%
HK	53	1.763%
BM	50	1.663%
CH	49	1.630%
SE	47	1.563%
SG	35	1.164%
MY	34	1.131%
ES	32	1.064%
NL	30	0.998%
ID	25	0.831%
IE	23	0.765%
IT	23	0.765%
RU	23	0.765%
MX	22	0.732%
BE	21	0.698%
CL	21	0.698%
FI	21	0.698%
TH	20	0.665%
TR	19	0.632%
DK	18	0.599%
NO	16	0.532%
PH	16	0.532%
NZ	13	0.432%
IL	12	0.399%
PL	12	0.399%
AT	10	0.333%
GR	10	0.333%
CO	8	0.266%
JE	8	0.266%
LU	7	0.233%
PT	7	0.233%
EG	5	0.166%
SA	5	0.166%
PE	4	0.133%
HU	3	0.100%
VG	3	0.100%
AE	2	0.067%
GG	2	0.067%
MA	2	0.067%
PA	2	0.067%
QA	2	0.067%
AN	1	0.033%
CZ	1	0.033%
IM	1	0.033%
KW	1	0.033%
LK	1	0.033%
LR	1	0.033%
MH	1	0.033%
MU	1	0.033%
OM	1	0.033%
PG	1	0.033%
UG	1	0.033%

Table 6: Unique firms in Data as of 31th Dec 2018

Total number of Unique firms: 3799

Country	N	%
US	1321	34.772%
CN	219	5.765%
GB	215	5.659%
CA	184	4.843%
AU	136	3.580%
DE	122	3.211%
FR	117	3.080%
JP	100	2.632%
SE	97	2.553%
CH	81	2.132%
TW	80	2.106%
KY	73	1.922%
IT	60	1.579%
BM	58	1.527%
NL	51	1.342%
ES	45	1.185%
HK	45	1.185%
NO	41	1.079%
BR	39	1.027%
BE	38	1.000%
IN	38	1.000%
KR	36	0.948%
ZA	35	0.921%
AR	32	0.842%
FI	31	0.816%
DK	29	0.763%
ID	29	0.763%
SG	28	0.737%
MX	27	0.711%
TH	27	0.711%
TR	26	0.684%
RU	25	0.658%
MY	24	0.632%
PL	24	0.632%
AT	23	0.605%
IE	22	0.579%
NZ	21	0.553%
CL	18	0.474%
IL	15	0.395%
PE	15	0.395%
PH	14	0.369%
LU	12	0.316%
PT	12	0.316%
SA	12	0.316%
CO	11	0.290%
GG	10	0.263%
GR	10	0.263%
JE	10	0.263%
AE	8	0.211%
QA	7	0.184%
MH	5	0.132%
HU	4	0.105%
KW	4	0.105%
VG	4	0.105%
BH	3	0.079%
CZ	3	0.079%
EG	3	0.079%
IM	3	0.079%
OM	3	0.079%
PA	3	0.079%
AN	1	0.026%
FO	1	0.026%
GI	1	0.026%
LI	1	0.026%
LK	1	0.026%
LR	1	0.026%
MA	1	0.026%
MU	1	0.026%
PG	1	0.026%
PR	1	0.026%
UG	1	0.026%

Table 7: ESG Total statistics per sample country

This table represents the summary statistics of ESG Total Scores based on country year-month observations.

Country	Mean	St. Dev.	Min	Max	N	Country	Mean	St. Dev.	Min	Max	N
AE	43.48	15.13	12.54	73.31	523	AN	70.82	8.72	54.02	85.62	197
AR	39.13	19.23	7.39	74.54	736	AT	56.85	13.69	22.84	85.16	2,034
AU	48.11	17.25	10.10	95.64	27,485	BE	53.76	15.72	12.42	87.13	3,432
BH	32.80	8.11	20.62	47.67	164	BM	44.94	17.52	10.64	88.93	7,629
BR	54.11	15.55	11.40	89.57	6,227	CA	47.77	16.25	7.91	93.34	22,624
CH	54.07	18.00	14.91	95.75	8,617	CL	46.36	16.09	8.53	79.05	3,035
CN	42.57	16.51	8.34	86.05	12,300	CO	47.92	15.61	21.90	88.91	1,033
CZ	48.99	12.77	30.95	83.03	275	DE	59.31	17.18	8.10	96.10	12,123
DK	53.07	13.63	18.66	79.60	3,383	EG	26.46	8.21	11.87	48.36	551
ES	62.09	17.74	7.82	94.35	5,027	FI	59.82	14.21	23.31	92.69	3,749
FO	47.92	0	47.92	47.92	5	FR	62.56	14.74	11.37	94.85	13,485
GB	56.25	15.29	9.60	95.16	37,366	GG	47.84	14.02	12.40	82.16	489
GI	48.25	3.70	42.63	52.70	41	GR	47.19	15.52	16.98	82.41	1,953
HK	46.13	16.74	13.24	81.88	7,055	HU	64.60	15.52	31.25	84.94	344
ID	50.45	18.07	12.43	90.89	2,592	IE	55.83	18.02	8.60	93.54	4,081
IL	45.16	17.17	10.23	80.39	1,542	IM	46.30	11.21	18.71	69.31	234
IN	54.74	16.34	19.44	94.91	8,065	IT	58.65	17.13	16.19	91.60	4,621
JE	49.39	16.59	16.79	80.54	1,199	JP	51.45	18.20	5.06	93.68	56,651
KE	59.93	4.21	50.51	63.36	41	KR	53.72	22.22	10.22	89.79	7,806
KW	43.48	19.86	17.96	74.89	359	KY	40.60	15.63	7.93	90.73	7,370
KZ	22.59	0	22.59	22.59	5	LI	26.49	0	26.49	26.49	5
LK	65.11	6.08	56.87	73.52	113	LR	56.05	7.53	45.28	69.05	149
LU	55.47	16.67	15.13	85.37	1,163	MA	38.02	18.59	13.71	67.65	202
MH	43.39	14.78	21.54	68.56	253	MT	70.43	3.40	65.26	74.01	41
MU	53.86	11.79	34.73	71.75	137	MX	49.30	19.61	11.85	86.13	2,594
MY	49.57	14.17	8.16	85.53	3,947	NL	59.63	17.15	16.32	95.02	5,399
NO	59.41	16.36	19.20	89.17	2,899	NZ	47.35	15.05	16.17	85.25	2,998
OM	33.69	9.51	18.17	53.26	164	PA	54.89	16.16	11.68	76.48	456
PE	40.47	15.30	14.73	72.14	912	PG	55.28	8.11	36.81	64.96	125
PH	47.93	17.96	12.46	89.13	1,755	PK	40.12	4.06	34.18	46.90	34
PL	45.85	16.05	17.01	79.75	1,572	PR	54.57	6.11	47.89	61.08	29
PT	62.65	14.74	21.24	87.50	1,129	QA	27.94	10.55	9.60	60.66	441
RU	48.92	15.47	11.23	86.41	3,183	SA	33.69	15.87	11.09	72.83	747
SE	59.39	15.47	10.58	94.86	8,837	SG	47.14	16.27	10.60	88.54	5,430
TH	57.38	15.32	17.75	87.45	2,348	TR	54.35	18.24	11.99	89.17	2,015
TW	44.56	19.09	8.57	86.92	11,554	UG	45.96	3.41	41.63	50.83	65
US	50.32	17.43	0	97.66	132,661	VG	50.57	7.37	34.02	65.67	316
ZA	54.52	14.98	8.05	93.13	8,715						

4. Methodology

Basis for the methods used in this thesis are derived from Serafeim (2020). Key difference to his approach is that I exclude analysis of public sentiment data, and only use the steps from the paper related to ESG Momentum. I use R (2013) for calculations and OLS estimations with packages Stargazer (2018), lfe (2019), dplyr (2018), tidyverse (2019), ggplot2 (2016) and qcc (2004).

In analyzing Market valuations of different ESG score variables, I use OLS-regression and estimate in total 6 models (Table Table 9 and Table 10) with natural logarithm of Market-to-book ratio as dependent variable. Interaction term between different scores is only included for Table 9 (formula 6). I include year-month and two-digit NAICS code fixed effects in all models. The estimated linear models are specified below in formulas 3, 4, 5, 6, 7, 8 and 9:

$$ln(MTB) = \beta_1 * \text{ESG Total Score} + \beta_2 * \text{ESG Controversies Score} + \textstyle\sum_{n=3}^{i} \beta_i * (Control_{\text{i}}) \tag{3}$$

$$ln(MTB) = \beta_1 * \text{ESG Total Score} + \textstyle\sum_{n=2}^{i} \beta_i * (Control_{\text{i}}) \tag{4}$$

$$ln(MTB) = \beta_1 * \text{ESG Controversies Score} + \textstyle\sum_{n=2}^{i} \beta_i * (Control_{\text{i}}) \tag{5}$$

$$\begin{aligned} ln(MTB) = {} & \beta_1 * \text{ESG Total Score} + \beta_2 * \text{ESG Controversies Score} \\ & + \beta_3 * \text{ESG Total Score} * \text{ESG Controversies Score} + \sum_{n=4}^{i} \beta_i * (Control_{\text{i}}) \end{aligned} \tag{6}$$

$$\begin{aligned} ln(MTB) = {} & \beta_1 * \text{ESG Controversies Score} + \beta_2 * \text{ESG ENV Score} \\ & + \beta_3 * \text{ESG SOC Score} + \beta_4 * \text{ESG GOV Score} + \sum_{n=5}^{i} \beta_i * (Control_{\text{i}}) \end{aligned} \tag{7}$$

$$\begin{aligned} ln(MTB) = {} & \beta_1 * \text{ESG ENV Score} + \beta_2 * \text{ESG SOC Score} \\ & + \beta_3 * \text{ESG GOV Score} + \sum_{n=4}^{i} \beta_i * (Control_{\text{i}}) \end{aligned} \tag{8}$$

$$ln(MTB) = \beta_1 * \text{ESG Total Score} + \beta_2 * \text{ESG Controversies Score} + \beta_3 * \text{ESG ENV Score} + \beta_4 * \text{ESG SOC Score} + \beta_5 * \text{ESG GOV Score} + \sum_{n=5}^{i} \beta_i * (Control_{\text{i}}) \quad (9)$$

In order to study time variation of the ESG Controversies Score and three ESG pillar scores, I estimate model 9 independently for each month in the sample. 2019 data is omitted since sample size (companies with ESG score) is less than 300 for all respective months at the time of download, which created substantial swings to the monthly coefficients. In order to observe any trends in coefficients over time, I exponentially smooth the estimated monthly coefficients with a lambda of 0.15. Plot is found in Figure 3 and discussed later in section 5.2.

First important step for preparing sufficient data for studying ESG momentum is calculating ESG change variables. As scores are typically updated once a year for a company, ESG score change only has a value different from zero only in one month per year. To overcome this, I copy the latest change value to to the following months until next score update. Due to dropped coverage, some companies disappear from data, but I keep companies in the sample for the following 12 months with the last ESG level and change values before the dropping them out of my sample. To ensure that ESG score data was available at the time (Note: ESG Controversies variable is a traceback variable as noted in section section 3), I use one month lagged values of ESG level and change to sort companies in given month where return for ESG portfolio is calculated.

Serafeim's detailed Factor variable definitions are presented in Table 8. These definitions are used to calculate returns for different types of ESG change and level portfolios. General process for Factor portfolios' construction is summarized in steps below.

1. Choosing an ESG score (Controversies, Total, ENV, SOC or GOV)

2. Sorting stocks to terciles, quartiles, quintiles and deciles based on both absolute change in ESG score and level of ESG score in previous month

3. Splitting stocks to TOP and BOT portfolios based on calculated limits for terciles, quartiles, quintiles and deciles and with given ESG1-ESG5 variable specifications presented in Table 8

4. Splitting TOP and BOT portfolios to small, mid and large based on Market cap size tercile

5. Calculating value weighted returns, monthly asset turnover, monthly number of stocks and average ESG scores from each size tercile

6. Calulating each Factor return, turnover, monthly number of stocks and average ESG scores with equal weights on the three size terciles

I note that Serafeim constructs portfolios for international sample by creating separate portfolios for each exchange country, and then taking an equal weighted return on all of these exchange country portfolios for ESG top and bottom. The justification for this is minimizing over-weighting of countries with specifically high or low ESG ratings. However, as monthly differences in ratings from table 7 present, countries that have a score mean that differs significantly from the full sample mean of 51.47 typically have a very low number of year-month observations. Countries that have more than 1000 year-month company observations have mean ESG Total Scores ranging between 42.57 (China) to 62.09 (Spain). All these countries also have a standard deviation ranging between 13.63 (Denmark) and 19.61 (Mexico). This ensures that even with lower mean scores, each of these countries have enough variation to have companies included sufficiently to both top and bottom portfolios. Additionally, ESG GOV Scores are country adjusted, which means that using one pool of companies already accounts for differences in governance practices between countries. I thereby expect my portfolios to be well-enough geographically distributed and not suffer from any tilts towards specific countries systematically through the sample. I also add that sample size in many countries is too small to construct top and bottom portfolios individually, hence I opt to use one pool of companies. Creating separate country portfolios and weighting them to calculate Factor returns would increase the risk of biases resulting from small sample sizes in smaller countries.

The regressions on the ESG factors are based on the four-factor model (Carhart, 1997)), including Fama-French (Fama & French, 1993) market, size, value factors and momentum factor introduced by Jegadeesh and Titman (1993). Remaining alpha and its significance will indicate the abnormal returns in each ESG portfolio. I will also test the significance of the differences between the estimated alphas from the three factors. Data for four-factor model is downloaded from AQR Capital Management, LLC (2020). I use the global dataset independent variables: factor-mimicking portfolios for market (MKT), size (SMB), momentum (UMD) and value (HML). Risk free rate (Rf) is the U.S. treasury bill rate. Later in Additional tests, I use U.S. and Europe risk factors from AQR Capital Management, LLC for the respective subsets. Estimated four-factor models are presented in formula 10,

$$\text{ESG}_{ij} - R_f = \alpha + \beta_1 * MKT + \beta_2 * SMB + \beta_3 * UMD + \beta_4 * HML \quad (10)$$

where i denotes the number of ESG Factor portfolio: ESG1, ESG2, ESG3, ESG4 and

ESG5. Index j denotes whether Factor portfolio has been sorted based on tercile, quartile, quintile or decile. ESG_{ij} is then Factor return in a given month, given the factor number and sorting method. Model is estimated for all different ESG scores, which means that 5 (scores) x 5 (Factor definitions) x 4 (splitting approaches) = 100 different long-short portfolios will be analysed in section 5.3.

To summarize, I contribute on top of Serafeim's work on Market valuation of ESG scores and Returns of ESG Factors with the analysis of multiple different types of ESG scores (Serafeim only looks at Total ESG score) and additionally by splitting the dataset to portfolios also with quartiles, quintiles and deciles (Serafeim only uses terciles). Additionally, I sort companies in my sample using the full dataset, not country-specific lists.

Table 8: ESG Factor definitions by Serafeim

This table exhibits steps used in constructing ESG Factor portfolios, defined by Serafeim. Each Factor ESG1 - ESG5 are replicated for all different ESG scores (Controversies, Total, ENV, SOC and GOV) and all sorting approaches (tercile, quartile, quintile and decile).

Factor	Description
ESG1	Each month, every stock is sorted independently in terciles, quartiles, quintiles and deciles according to the change in given ESG score in previous month and to terciles according to beginning of month market capitalization. For the firms in the top tercile, quartile, quintile and decile of ESG change, value weighted returns within each size tercile ($ESG_{TOPsmall}$, ESG_{TOPmid}, $ESG_{TOPlarge}$) are calculated each month. The equal weighted return across the three size terciles ($ESG_{TOPsmall}$, ESG_{TOPmid}, $ESG_{TOPlarge}$) is the return for that month ESG_{TOP}. For the firms in the bottom tercile, quartile, quintile and decile of ESG change, value weighted returns within each size tercile are calculated each month ($ESG_{BOTsmall}$, ESG_{BOTmid}, $ESG_{BOTlarge}$). The equal weighted return across the three size terciles ($ESG_{BOTsmall}$, ESG_{BOTmid}, $ESG_{BOTlarge}$) is the return for that month ESG_{BOT}. ESG1 is the difference between ESG_{TOP} and ESG_{BOT} in each month.
ESG2	Each month, every stock is sorted independently in terciles, quartiles, quintiles and deciles according to the level of given ESG score in previous month and to terciles according to beginning of month market capitalization. For the firms in the top tercile, quartile, quintile and decile of ESG change, value weighted returns within each size tercile ($ESG_{TOPsmall}$, ESG_{TOPmid}, $ESG_{TOPlarge}$) are calculated each month. The equal weighted return across the three size terciles ($ESG_{TOPsmall}$, ESG_{TOPmid}, $ESG_{TOPlarge}$) is the return for that month ESG_{TOP}. For the firms in the bottom tercile, quartile, quintile and decile of ESG change, value weighted returns within each size tercile are calculated each month ($ESG_{BOTsmall}$, ESG_{BOTmid}, $ESG_{BOTlarge}$). The equal weighted return across the three size terciles ($ESG_{BOTsmall}$, ESG_{BOTmid}, $ESG_{BOTlarge}$) is the return for that month ESG_{BOT}. ESG2 is the difference between ESG_{TOP} and ESG_{BOT} in each month.
ESG3	ESG3 follows the same process with ESG1 but excludes companies in a given month from the TOP (BOT) portfolio that are in the bottom (top) tercile of ESG performance level.
ESG4	ESG4 follows the same process with ESG2 but excludes companies in a given month from the TOP (BOT) portfolio that are in the bottom (top) tercile of ESG performance change.
ESG5	ESG5 combines in the TOP (BOT) portfolio, in any given month, stocks that are in ESG1 or ESG2 TOP (BOT) portfolio and imposes absolute filters. Excludes companies from the TOP portfolio with lower than ESG B rating (smaller than 53.333 ESG score) or negative ESG performance change in a given month. Excludes companies from the BOTTOM portfolio with ESG A rating and above (bigger than 83.333 ESG score) or positive ESG performance change in a given month.

5. Results and discussion

5.1. Summary of results

I find positive and statistically significant coefficients for ESG Controversies, ESG SOC and ESG GOV in market valuation regressions. Of these three, ESG GOV has the largest effect, followed by ESG Controversies and ESG SOC, measured by estimated coefficient value. One point increase in ESG Controversies Score indicated a 0.31 % increase in market valuation, ESG SOC an increase of 0.06 %, and ESG GOV an increase of 0.47 % (table 10, model 3). In practice this means that through August 2002 to December 2019, for instance a company with ESG GOV rating of 80 would have had 4.7 % higher valuation compared to a company with ESG GOV rating of 70.

ESG Total and ESG ENV had both negative and statistically significant effect on the market valuation. One point increase in ESG Total Score indicated a decrease between 0.19 % and 0.78 %, depending on model specification (Models 1, 2 and 4 in table 9, Model 3 in table 10). Logical explanation for negative valuation coefficients is the irrelevance of ESG activities to majority of companies, which could be specifically true for environmental activities. ESG ENV is the main contributor of negative coefficient of ESG Total Score, but there also is some statistically significant negative effect in ESG Total Score independent of pillar and Controversies Scores. After adding interaction term of ESG Total and ESG Controversies Scores to the model 4 in table 9, main effects turn negative whereas interaction term has a significant and positive coefficient.

ESG Scores and their market valuations have seen variation across the sample period, with some trends visible from plotted monthly coefficients. ESG Controversies and ESG GOV exhibited a positive coefficient throughout the whole sample period, whereas ESG ENV's estimated coefficient remained negative throughout the sample. ESG Controversies' coefficient has been steadily increasing through 2008 to 2019, and has seen less variation than other scores. ESG Total's coefficient was first positive in years 2002 to 2008, but turned negative for the period 2008 to 2017. However, a fast increase in coefficient value was already started in 2013. ESG SOC's coefficient saw a steady increase until mid 2013, after which it has been on a decline and was slightly negative in years 2017-2019.

Results on ESG scores and market valuations do not translate directly to excess stock returns from ESG Factor portfolios. For instance, I find positive and statistically significant abnormal returns for ESG Total factor portfolios in spite of negative Market-to-book coefficient. Difference of monthly average raw return for top and bottom portfolios is statistically insignificant across almost all portfolio construction approaches (see Appendix tables 41, 42, 43, 44 and 45). Despite this, I find statistically significant and positive risk-adjusted returns from ESG Total and ESG SOC factors, using four-factor model. Of

the two, ESG Total portfolios generated larger monthly alpha with a range of 0.25 % to 0.38 % compared to ESG SOC's range of 0.23 % to 0.29 %.

Factor returns are not fully independent of other Carhart risk factors, as all constructed ESG Factor portfolios are negatively correlated with market returns. Other correlations with risk factors and their significance vary both between scores and Factor construction methods. Overall, results are more significant for portfolios that are sorted based on ESG change (ESG1 and ESG3) and for portfolios that are sorted using deciles. I draw a conclusion that the abnormal returns are explained more by standard deviations rather than by the mean levels of returns, since differences between raw returns of top and bottom portfolios are widely statistically insignificant. Thus, I expect the abnormal risk-adjusted returns to generate from lower risk rather than mediation factors such as bargaining power, brand value, differentiation or social "license to do business" (Kiernan, 2001).

5.2. ESG Score Valuation results and discussion

Analysis of ESG scores and firm valuations yields rather surprising results. Contrary to Serafeim's findings from MSCI data, Refinitiv's ESG Total Score has a statistically significant ($p < 0.01$), negative coefficient in both models 1 and 2 in table 9. ESG Controversies, however, has a statistically significant ($p < 0.01$) and positive coefficient in both models 1 and 3. When looking at model 1, where both ESG Total Score and Controversies Score are regressed on Log Market-to-book without interaction term, one point increase in ESG Total rating indicates a 0.52 % drop in valuation and one point increase in ESG Controversies Score a 0.23 % increase in valuation for an average company.

When I add interaction term in model 4, effect of ESG Controversies Score turns negative. Similarly to Aouadi and Marsat (2018), interaction term of Controversies Score and Total Score is positive and significant. It is hard to interpret the implications for companies: on the other hand, based on the model, higher score from the interaction term yields higher valuations, whereas the independent effects are negative. When estimated coefficients are tested with the range of 1-100 with both scores, results imply that there are no combinations of ESG Controversies and ESG Total Score, that would create a total positive effect on Market-to-book ratio, if individual effects and the interaction term are both included. Without interaction term, there are combinations with total positive contribution with low ESG Total Score (smaller than 30) and high ESG Controversies Score (larger than 75), but these type of companies represent only a minor fraction of the total sample. I also note that R-squared and adjusted R-squared remain unchanged between models 1 to 4, which implies that model fit is still the same without the interaction term. For this reason and simplicity, I continue my analysis of pillar scores without the interaction terms.

The most logical explanation for value destroying effect of ESG Total Score is that the ESG performance is irrelevant for majority of industries, and therefore it indicates a value destroying effect on average. However, any bad press indicated by the ESG Controversies Score is naturally value destroying for companies, and therefore a positive and significant coefficient for ESG Controversies is found. This implicates that it is very difficult for firms to extract value from ESG activities: on the other hand, ESG activities destroy value on average, but if the company ends up in an ESG scandal, it is wasteful of shareholder value. This conveys that any decisions on resource allocation towards ESG activities need to be assessed with a holistic cost-benefit approach. New ESG activities need to either or both create more profits and decrease risk of any ESG scandals to an extent that it exceeds the resources used to improve this ESG related process. My results suggest that majority of companies fail to do so, or the increased revenues and decreased risk will materialize in the future. These results are in line with work of Xie et al. (2019), as he finds that high overall ESG score is a negative determinant of corporate efficiency. Future research could look more into to the predicting power of ESG scores on the number of ESG controversies, which would prove to be beneficial when assessing how much ESG risks are actually mitigated by ESG activities.

After extending analysis to pillar scores (table 10), I find that the contributions of ESG ENV, SOC and GOV differ significantly between one another. Based on the estimated models, ESG ENV seems to be the contributor to the negative effect of ESG Total. In both models 1 and 2 ESG ENV Score has a statistically significant ($p < 0.01$) and negative coefficient. In model 1, where both ESG Controversies Score and pillar scores are included, one point score increase in ESG ENV indicates a drop of 0.62 % in valuation. Coefficient drops slightly when ESG Total is added in model 4, but still indicates a drop of 0.58 % per one point score increase. Logical explanation for this could be the irrelevance of environmental performance to most companies. Environmental performance is especially screened for power and utilities companies and manufacturing companies, but these industries constitute only a fraction of the total sample. Whereas social responsibility and good governance have direct benefits to a company regardless of the industry, environmental activities might go unnoticed by investors and clients and therefore resources used to improve environmental performance destroy value for an average firm.

ESG SOC and ESG GOV both have a statistically significant and positive coefficients ($p < 0.01$). Of the two, ESG GOV has a larger effect by a wide margin, a coefficient between 0.0042 and 0.0047 in models 1 to 3 in table 10, compared to ESG SOC's coefficient between 0.0002 and 0.0006. It makes sense that ESG GOV has a significant and positive effect on market valuation, since the score summarizes all many elements of good governance. ESG GOV Score includes themes CSR strategy, ESG reporting and transparency, Structure (independence, diversity, committees), Compensation, Shareholder rights and takeover

defenses. Overall, my results are in line with Nguyen et al. (2020), who also found positive effects for other dimensions than environmental activities.

Majority of the negative effect of ESG Total disappears in Model 4, when valuation is controlled with all five ESG scores. Statistically significant coefficient of -0.0019 still remains, which means that there is some value destroying effect in Total ESG score that pillars and Controversies Score do not control. Interpretation is difficult, as ESG Total is a weighted score from the three pillars, and therefore should not in theory have any independent effect separately from pillars. Explanation for this could be that if the scores truly are a true representation of company's performance in all dimensions, there are some ESG activities that are not fully captured by ESG pillars or ESG Controversies Score. These "unclassified" ESG activities are value destroying in my sample, indicated by negative coefficient. Ratings being a true reflection of the ESG performance is a highly theoretical concept, and more feasible explanation could be that ESG Total Score communicates something else about the ESG activities and value creation of a company in general than what the controversies and pillar scores communicate independently. A high Total Score would on average indicate wasteful use of resources, even with optimal values for other ESG pillars and Controversies Score. Higher scoring firms tend to engage in variety of ESG activities across all the three pillars (as Total Scores a weighted score of the three), and lost focus and scattered resource allocation might be the key reason for not realizing the profit or risk reduction gains. If this holds, average company might be better off when they have a sub-average ESG Total rating, but channel their resources to ensure good governance practices and rating.

Time variation plot (figure 3) of coefficients in model 3 in table 10 entails interesting trends. When interpreting results from the plot, it is important to bear in mind that due to exponential smoothing, plot shows some delay to actual stock price trends in given timeline. Hence, stock price reactions presented later in Factor plots in section 5.3 happen slightly earlier than the trend in valuation coefficient plot would indicate.

ESG Controversies Score's monthly coefficient has experienced a steady increase through August 2002 to June 2019. Logical explanation for this would be that media is paying much closer attention to scandals related to ESG now than it was 17 years a ago. With other scores, I find much more variation over time. ESG Total's coefficient was moving around zero in years 2002 to 2007, after which it started a rapid decline that lasted until 2013. Since then, ESG Total's coefficient has been increasing quickly.

ESG ENV's coefficient has been negative through the whole sample period with an overall downward trend. ESG SOC's coefficient was positive until 2015, when it dropped below zero as a result from swift decrease that started in 2014. Interestingly, ESG SOC's coefficient is almost a perfect mirror of ESG Total's coefficient. Based on the plot, it seems

that when social performance is viewed as a value creating determinant by the market, overall ESG activities are viewed value destroying.

ESG GOV's coefficient was rather steady and positive before financial crisis, after which it started an upward trend that lasted until 2015. Explanation for the change could be governance being one of the reasons for the financial crisis outbreak, which might have shifted investor's attention to pay close attention to governance issues and fix incentive models. After 2015, ESG GOV's coefficient has been on decline, but remains still positive at the end of the sample period.

To summarize my results in this part, it seems that the most important determinants of market valuations within ESG universe are ESG Controversies Score, ESG ENV and ESG GOV Scores. Higher ESG Total Score has a value destroying effect, mostly due to negative coefficient of ESG ENV. My results suggest that shareholders are better off if the company focuses on good governance and minimizing bad press: improving social performance only has a small effect, and environmental performance a value destroying effect. I note that optimizing these different performance metrics could prove to be difficult in practice as it would require an environment where management could address these areas completely separately from each other.

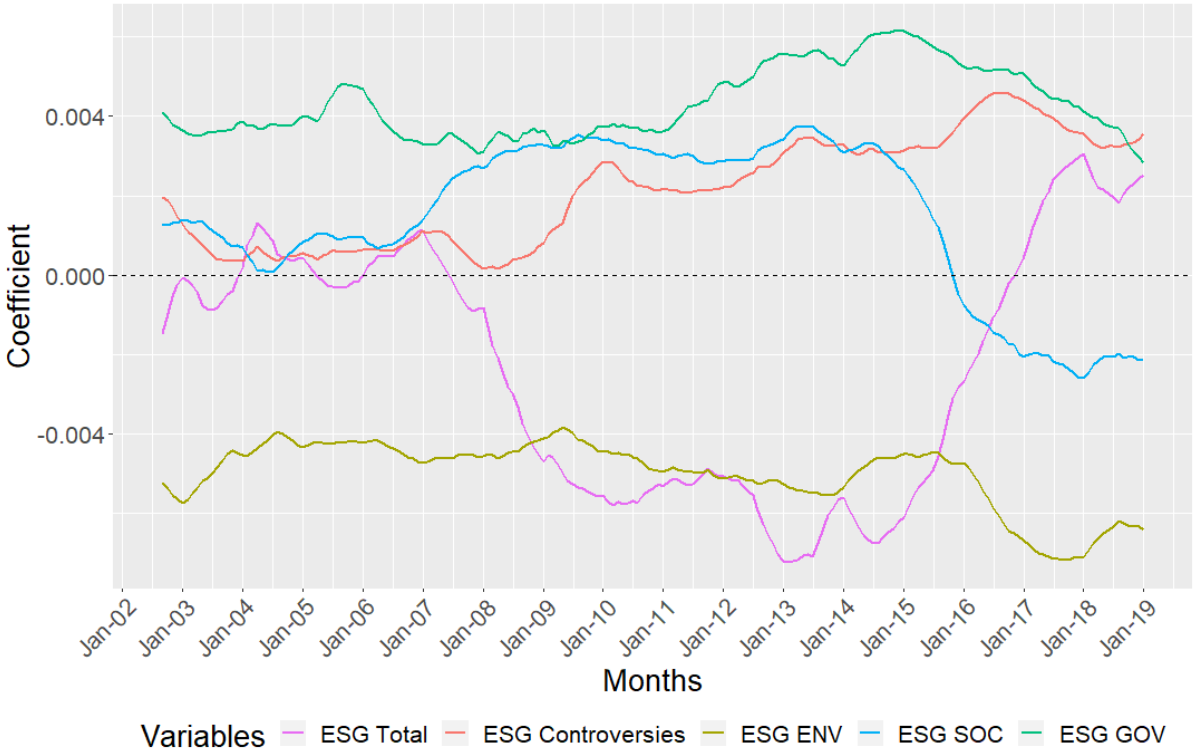


Figure 3: Monthly regression coefficients Aug 2002 - Jun 2019

This figure presents exponentially smoothed regression coefficients over time August 2002 - June 2019. Coefficients are estimated by running an individual regression specified by formula 9 on page 26

Table 9: Market-to-book regressions: Total Scores

This table presents statistics from regressions on natural logarithm of Market-to-book ratio, with ESG Controversies Score and ESG Total Score as independent variables along with controls. Leverage denotes the ratio of Total Debt to Common Equity, Log MKT Cap previous month close the natural logarithm of the previous month closing Market capitalization in USD, Log MTB the natural logarithm of Market-to-book ratio, Past return the stock return over last 6 months, Sales growth the 1-year growth in revenues and ROE the return on Equity. Linear model definitions for (1) to (4) can be found from equations 3, 4, 5 and 6.

	Dependent variable:			
	Log Market-to-book			
	(1)	(2)	(3)	(4)
ESG Total Score	−0.0052	−0.0057		−0.0078
	t = −74.16***	t = −81.49***		t = −45.68***
ESG Controversies Score	0.0023		0.0030	−0.0007
	t = 39.55***		t = 51.93***	t = −3.81***
ESG Total Score X ESG Controversies Score				0.0001
				t = 16.62***
Log MKT Cap previous month close	0.1935	0.1848	0.1653	0.1952
	t = 211.47***	t = 207.73***	t = 197.48***	t = 212.05***
Past return	0.4147	0.4198	0.4272	0.4144
	t = 113.71***	t = 115.00***	t = 116.60***	t = 113.67***
Sales growth	0.00002	0.00001	0.00002	0.00002
	t = 1.00	t = 0.96	t = 1.13	t = 1.02
ROE	0.0326	0.0330	0.0327	0.0325
	t = 49.89***	t = 50.42***	t = 49.76***	t = 49.76***
Leverage	0.0187	0.0186	0.0187	0.0187
	t = 125.02***	t = 124.07***	t = 124.16***	t = 125.04***
Year-month fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	478,836	478,836	478,836	478,836
R^2	0.217	0.214	0.208	0.217
Adjusted R^2	0.216	0.214	0.207	0.217
Residual Std. Error	0.743 (df = 478601)	0.744 (df = 478602)	0.747 (df = 478602)	0.743 (df = 478600)

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 10: Market-to-book regressions: pillar scores

This table presents statistics from regressions on natural logarithm of Market-to-book ratio, with ESG Total Score, ESG Controversies Score and ESG pillar scores as independent variables along with controls. Leverage denotes the ratio of Total Debt to Common Equity, Log MKT Cap previous month close the natural logarithm of the previous month closing Market capitalization in USD, Log MTB the natural logarithm of Market-to-book ratio, Past return the stock return over last 6 months, Sales growth the 1-year growth in revenues and ROE the return on Equity. Linear model definitions for (1) to (3) can be found from equations 7, 8 and 9

	Dependent variable:		
	Log Market-to-book		
	(1)	(2)	(3)
ESG Total Score			−0.0019
			t = −16.16***
ESG Controversies Score	0.0032		0.0031
	t = 56.25***		t = 54.48***
ESG ENV	−0.0062	−0.0065	−0.0058
	t = −103.16***	t = −108.73***	t = −89.92***
ESG SOC	0.0002	0.0004	0.0006
	t = 3.19***	t = 6.02***	t = 9.51***
ESG GOV	0.0045	0.0042	0.0047
	t = 121.20***	t = 113.33***	t = 120.64***
Log MKT Cap previous month close	0.2028	0.1896	0.2053
	t = 230.56***	t = 222.92***	t = 229.90***
Past return	0.3984	0.4059	0.3981
	t = 112.49***	t = 114.32***	t = 112.43***
Sales growth	−0.000004	−0.000005	−0.000002
	t = −0.2754	t = −0.3273	t = −0.1663
ROE	0.0319	0.0325	0.0318
	t = 50.33***	t = 51.09***	t = 50.24***
Leverage	0.0186	0.0184	0.0185
	t = 127.89***	t = 126.52***	t = 127.80***
Observations	478,766	478,766	478,766
R^2	0.2622	0.2573	0.2626
Adjusted R^2	0.2618	0.2569	0.2622
Residual Std. Error	0.7209 (df = 478529)	0.7232 (df = 478530)	0.7207 (df = 478528)
Note:			*p<0.1; **p<0.05; ***p<0.01

5.3. ESG Factor portfolio results and discussion

On following pages, I discuss results from ESG Factor portfolios. I present plotted time series returns from all ESG change and level portfolios (ESG1-ESG5, decile sorts) for each ESG score, as well as Carhart regression tables with statistically significant alphas at least with a significance level of 0.1. Carhart regressions with no statistically significant alpha are found in appendix A. As I plot Factor returns using decile sorts, ESG1 and ESG3 are in many cases identical or close to identical, since it is rare that a top decile performer in ESG change would be a bottom deile performer in ESG level. Same observation and reasoning holds for ESG level portfolios ESG2 and ESG4.

5.3.1. ESG Controversies factor portfolios

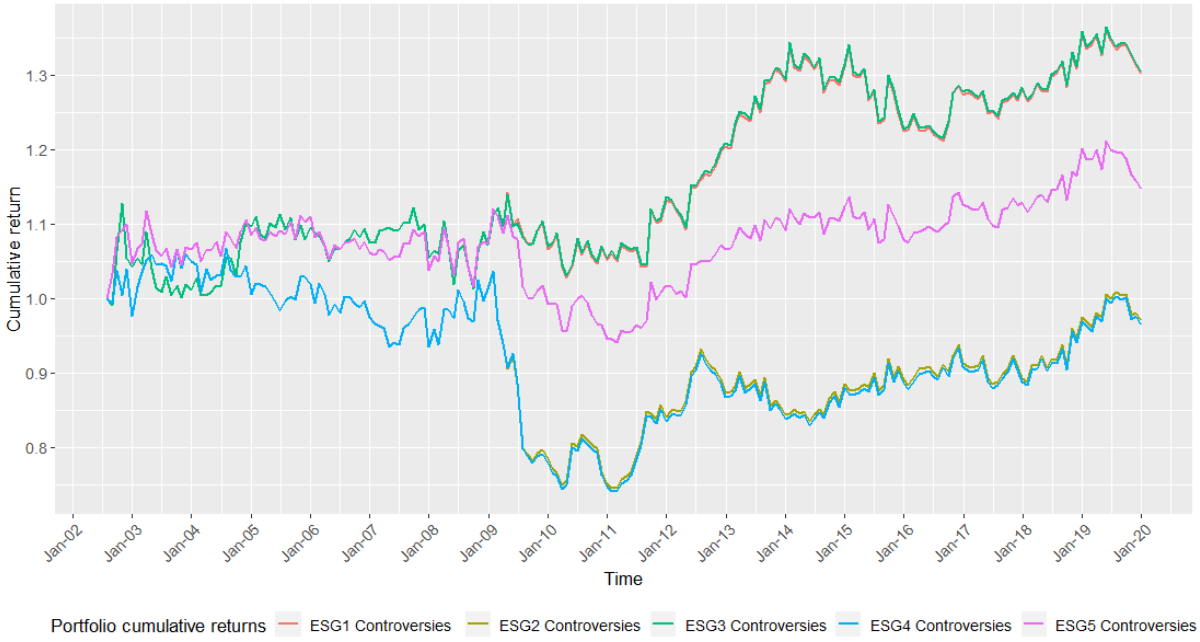


Figure 4: ESG Controversies portfolios' cumulative returns
This figure presents cumulative returns ESG Controversies Factor portfolios created with decile sorts

When looking at ESG Controversies portfolios' performance over time (figure 4), I find that change-sorted portfolios ESG1 and ESG3 generated cumulative returns of around 30 % through the sample period. level-sorted portfolios ESG2 and ESG4 accumulated negative returns of around 3 % until January 2020, whereas combined approach ESG5 yielded cumulative return of roughly 15 %. All the five factors are correlated with one another, although volatility of returns varies a lot. Performance of all Controversies factor portfolios improved significantly from the start of 2010 and accumulated positive return until the end of sample period. Time variation of valuation coefficient is in line with the plotted excess stock returns, as ESG premium was already in stock prices at the start of

the sample period and increase in coefficient value that started in 2009 can also be seen in portfolio returns.

Although ESG Controversies Score was a significant, positive determinant of value in Market-to-book regressions, there is only statistically weak evidence of abnormal returns in four-factor model. When looking at the summary statistics for ESG Controversies portfolios (table 41), none of the long-short portfolios' mean returns differ significantly from zero (see column T-stat), although they are all positive. However, portfolios sorted with Controversies change (ESG1 and ESG3) (table 11 and table 12) present evidence of positive alpha with a p-level of 0.1. This evidence is from Factor portfolios split with deciles, and in both portfolios monthly alpha is 0.23 %.

Results on level and combined-sorted portfolios (ESG2, ESG4 and ESG5) are not statistically significant, which suggests that change in ESG Controversies Score is a more important determinant of stock returns than actual level. One explanation for statistically weak results could be that any scandals occurring in the media, whether it be ESG related or not, cannot be effectively captured by a mechanical trading strategy with one-month re-balancing. Second, from figure 3 it is also visible that MTB coefficient was already on a high and positive level at the start of the sample period, hence I can assume that this value was already in stock prices when portfolio is set up. Both these reasons were likely contributors to the statistically weak evidence.

All ESG Controversies Score factor portfolios are negatively and significantly correlated with market returns. Most of the portfolios sorted with ESG level in the fist step were additionally negatively and significantly correlated with UMD term (table 51, table 52, table 53), and I also find some evidence of negative correlation with HML term (ESG1 quartile, ESG2 tercile, ESG4 tercile).

There is little to no variation in monthly portfolio asset turnovers, average number of stocks or mean ESG Controversies Scores (see table 46 in Appendix A) regardless of the portfolio sorting method. Mean monthly asset turnover ranges between 9 % to 15 % for all portfolios. Decile sorted portfolios consist on average from at least 297 stocks per month, which means that all studied portfolios have significant enough diversification.

Table 11: ESG Controversies change (ESG1) Factor portfolio returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG1 tercile	ESG1 quartile	ESG1 quintile	ESG1 decile
	(1)	(2)	(3)	(4)
MKT	−0.2513	−0.2413	−0.2485	−0.2547
	t = −9.72***	t = −9.55***	t = −8.48***	t = −7.61***
SMB	0.1245	0.1243	0.1268	0.0707
	t = 1.82*	t = 1.86*	t = 1.63	t = 0.80
HML	−0.0503	−0.1273	−0.1081	−0.0309
	t = −0.78	t = −2.02**	t = −1.48	t = −0.37
UMD	−0.0477	−0.0435	−0.0424	−0.0558
	t = −1.61	t = −1.50	t = −1.26	t = −1.45
Constant	0.0011	0.0013	0.0017	0.0023
	t = 1.05	t = 1.31	t = 1.44	t = 1.72*
Observations	210	210	210	210
R^2	0.3389	0.3467	0.2917	0.2370
Adjusted R^2	0.3260	0.3339	0.2779	0.2221
Residual Std. Error (df = 205)	0.0143	0.0139	0.0162	0.0185
F Statistic (df = 4; 205)	26.2681***	27.1940***	21.1073***	15.9159***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 12: ESG Controversies change accounting for level (ESG3) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG3 tercile	ESG3 quartile	ESG3 quintile	ESG3 decile
	(1)	(2)	(3)	(4)
MKT	−0.2418	−0.2316	−0.2431	−0.2535
	t = −9.45***	t = −8.75***	t = −8.19***	t = −7.59***
SMB	0.0889	0.0992	0.1209	0.0659
	t = 1.31	t = 1.42	t = 1.54	t = 0.75
HML	−0.0447	−0.1258	−0.1064	−0.0241
	t = −0.70	t = −1.90*	t = −1.43	t = −0.29
UMD	−0.0558	−0.0383	−0.0345	−0.0538
	t = −1.90*	t = −1.26	t = −1.01	t = −1.40
Constant	0.0011	0.0015	0.0019	0.0023
	t = 1.08	t = 1.40	t = 1.60	t = 1.72*
Observations	210	210	210	210
R^2	0.3228	0.3115	0.2811	0.2366
Adjusted R^2	0.3096	0.2981	0.2671	0.2217
Residual Std. Error (df = 205)	0.0141	0.0146	0.0164	0.0184
F Statistic (df = 4; 205)	24.4264***	23.1923***	20.0385***	15.8840***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

5.3.2. ESG Total factor portfolios

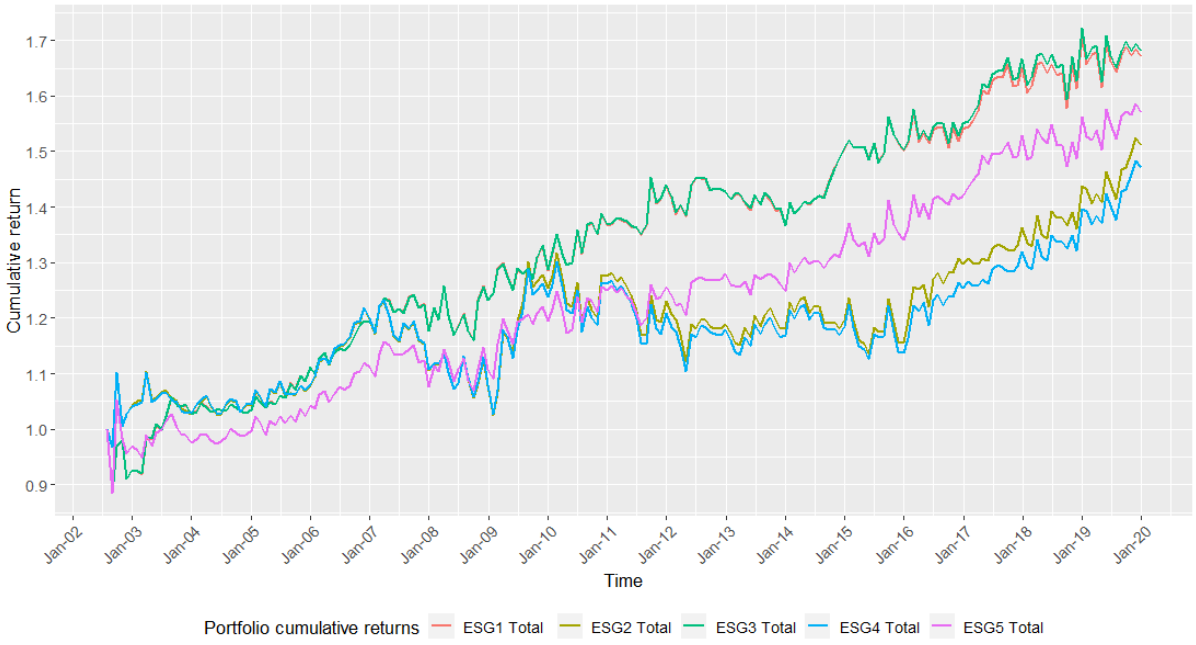


Figure 5: ESG Total portfolios' cumulative returns
This figure presents cumulative returns for ESG Total Factor portfolios created with decile sorts

ESG Total factor regressions yield surprising results in the light of the negative and statistically significant results from market valuations, although rapid increase in ESG Total factors coefficient in years 2014-2018 (see figure 3) affected factor returns positively in the last years of study period. With all change, level and sorting approaches, top portfolios outperform the the bottom portfolios, but the sample mean is statistically significant and positive only with change factors ESG1 and ESG3 sorted with deciles (see table 42 in appendix A).

All factor portfolios yielded positive cumulative returns through the sample period, as time series of returns in Figure 5 shows. Similarly to ESG Controversies, change-sorted portfolios outperformed level portfolios, racking up 70 % cumulative returns compared to 57 % of combined approach (ESG5) and level-sorted returns of 50 % and 47 % (ESG2 and ESG4). Volatility varied less between Total portfolios compared to ESG Controversies and all portfolios remained at positive cumulative return from 2005 onward.

I find statistically significant and positive alpha from factors sorted with change in Total Score (table 13, table 14). From change factor (ESG1), I find a monthly alpha of 0.27 % with quintile sorts (significance level of 0.05) and with decile factor an alpha of 0.37 % (significance level of 0.01). When change is accounted for ESG level (ESG3), I find an alpha of 0.25 % with quartile sorts (significance level of 0.05) and an alpha of 0.38 % decile sorts (p-level of 0.01).

Again, I find significant and negative correlation with market returns from all portfolios.

Portfolios are also positively correlated with SMB term, most with statistical significance. Portfolio asset turnovers, average number of stocks and mean ESG Controversies Scores (see table 46) do not vary significantly between ESG1-ESG5 portfolios. Mean monthly asset turnover ranges between 8 % to 13 % and average number of stocks in portfolios range between 294 and 1079. In comparison with Serafeim's results, I also find statistically significant and positive alpha with ESG Total Score (Note: Serafeim finds it with MSCI data). Serafeim finds it for ESG1 and ESG2 using terciles, whereas I find the effect with ESG1 and ESG3, using quartiles, quintiles and deciles.

The explanation for the disparity between the market valuation and excess stock returns with ESG Total could be the portfolio construction method. Sorting approach might choose companies whose sustainability activities are not deemed wasteful of shareholder value, contrary to what one would hypothesize based on the negative coefficient from the market valuation regression. This might happen for instance when top ESG Total performers happen to be in countries where ESG Total Score valuation is inverted from the full sample, although as discussed in section 4, I expect the probability of this to be relatively small.

More probable explanation is that even with a value destroying effect of ESG Total in the full valuation sample, for top performers ESG Total Score might still hold more value, as it could accumulate more positive press and media attention compared to mid performers. In the same way, bottom performers' environmentally and socially unfriendly activities might create a vicious cycle of unfavourable publicity and additional negative news coverage. If this is true, my long-short portfolios are able to capture this value creating effect of ESG Total in returns, whereas the middle basket of companies with value destroying ESG Total performance do not affect my portfolio returns. Additional analysis of ESG score valuation for different score levels would be needed to confirm this explanation, but findings of more significant effect among high attention and well performing firms by Aouadi and Marsat (2018) support my hypothesis.

Table 13: ESG Total change (ESG1) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG1 tercile	ESG1 quartile	ESG1 quintile	ESG1 decile
	(1)	(2)	(3)	(4)
MKT	−0.2711	−0.2822	−0.2849	−0.2970
	t = −9.44***	t = −8.67***	t = −8.54***	t = −8.36***
SMB	0.1741	0.1810	0.2077	0.2186
	t = 2.29**	t = 2.10**	t = 2.35**	t = 2.32**
HML	0.0043	−0.0248	−0.0168	−0.0199
	t = 0.06	t = −0.31	t = −0.20	t = −0.22
UMD	−0.0173	−0.0208	−0.0149	−0.0181
	t = −0.53	t = −0.56	t = −0.39	t = −0.44
Constant	0.0021	0.0024	0.0027	0.0037
	t = 1.86*	t = 1.84*	t = 2.06**	t = 2.66***
Observations	210	210	210	210
R^2	0.3370	0.3009	0.2971	0.2869
Adjusted R^2	0.3240	0.2873	0.2834	0.2730
Residual Std. Error (df = 205)	0.0158	0.0179	0.0184	0.0196
F Statistic (df = 4; 205)	26.0469***	22.0585***	21.6613***	20.6205***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 14: ESG Total change accounting for level (ESG3) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG3 tercile	ESG3 quartile	ESG3 quintile	ESG3 decile
	(1)	(2)	(3)	(4)
MKT	−0.2736	−0.2812	−0.2812	−0.2977
	t = −9.01***	t = −8.95***	t = −8.61***	t = −8.35***
SMB	0.2213	0.1804	0.2122	0.2172
	t = 2.75***	t = 2.17**	t = 2.45**	t = 2.30**
HML	0.0206	−0.0004	−0.0036	−0.0221
	t = 0.27	t = −0.004	t = −0.04	t = −0.25
UMD	−0.0283	−0.0252	−0.0145	−0.0189
	t = −0.81	t = −0.701	t = −0.39	t = −0.46
Constant	0.0022	0.0025	0.0025	0.0038
	t = 1.88*	t = 2.04**	t = 1.96*	t = 2.68***
Observations	210	210	210	210
R^2	0.3106	0.3100	0.2995	0.2864
Adjusted R^2	0.2972	0.2965	0.2859	0.2725
Residual Std. Error (df = 205)	0.0167	0.0173	0.0180	0.0197
F Statistic (df = 4; 205)	23.0926***	23.0228***	21.9146***	20.5700***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 15: ESG Total change and level combined (ESG5) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG5 tercile	ESG5 quartile	ESG5 quintile	ESG5 decile
	(1)	(2)	(3)	(4)
MKT	−0.2711	−0.2770	−0.2792	−0.2948
	t = −7.88***	t = −7.41***	t = −7.12***	t = −7.29***
SMB	0.2604	0.2814	0.3086	0.3143
	t = 2.86***	t = 2.84***	t = 2.97***	t = 2.94***
HML	−0.0041	0.0072	0.0098	0.0460
	t = −0.05	t = 0.08	t = 0.20	t = 0.45
UMD	−0.0165	−0.0078	0.0026	0.0143
	t = −0.42	t = −0.18	t = 0.06	t = 0.31
Constant	0.0016	0.0020	0.0019	0.0031
	t = 1.21	t = 1.32	t = 1.24	t = 1.94*
Observations	210	210	210	210
R^2	0.2643	0.2453	0.2369	0.2488
Adjusted R^2	0.2500	0.2305	0.2220	0.2341
Residual Std. Error (df = 205)	0.0190	0.0206	0.0216	0.0223
F Statistic (df = 4; 205)	18.4150***	16.6551***	15.9087***	16.9701***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

5.3.3. ESG ENV factor portfolios

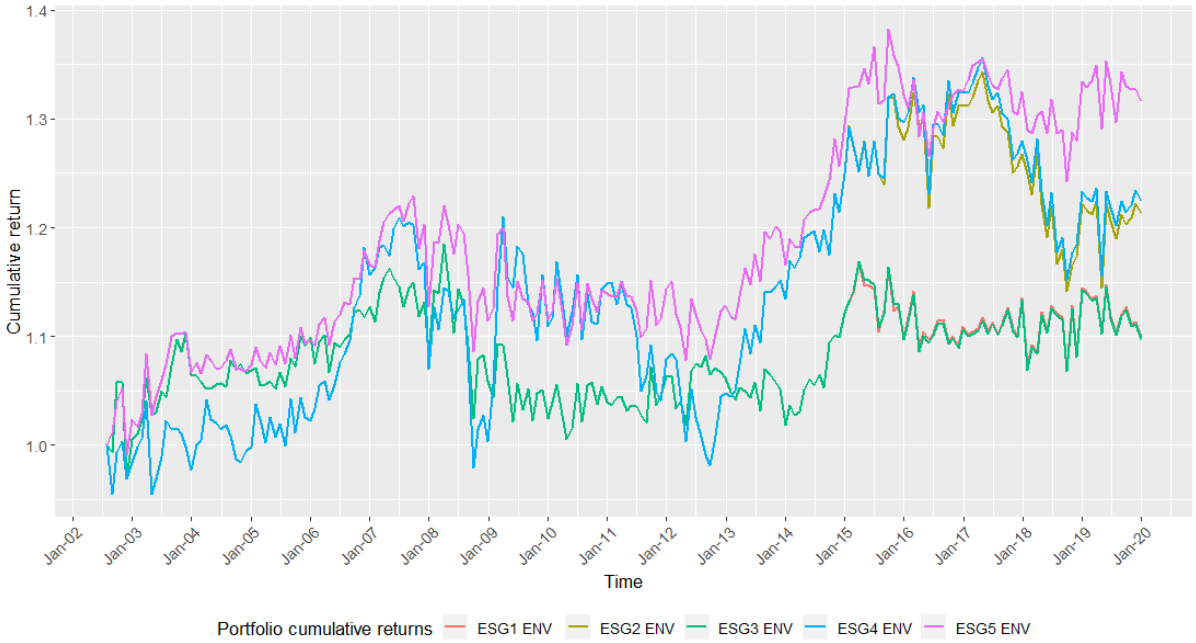


Figure 6: ESG ENV portfolios' cumulative returns
This figure presents cumulative returns for ESG ENV Factor portfolios created with decile sorts

In spite of MTB regression coefficients being significantly negative, only two of the bottom portfolios outperformed their respective top portfolios with ESG ENV Score (see ESG2 quintile long-short and ESG4 quintile long-short in table 43). Yet, none of the long-short portfolio raw mean returns differ significantly from zero (see Appendix, table 43). Contrary to Controversies and Total Score, cumulative returns are larger for level-sorted portfolios than for change-sorted portfolios (see figure 6). The highest returns were generated by combined approach (ESG5), a cumulative return of around 33 %. All factors yielded positive cumulative return from 2002 to 2019, but combined factors (ESG5) performed especially well compared to other factors between 2016 and 2019. Again, all portfolios are negatively correlated with market returns (significance level 0.01) and similarly to ESG Total, all portfolios are positively correlated with SMB term. Monthly asset turnovers are in line with ESG Controversies and ESG Total portfolios (see Appendix table 48).

No alphas of statistical significance can be found from Carhart regressions, although all coefficients are positive. Similarly to ESG Total, I assume that the most logical explanation for different results compared to valuation coefficients is again the irrelevance of ESG score to majority of companies in the sample. This explanation is even more logical for ESG ENV, as environmental performance specifically can be highly irrelevant to many industries.

5.3.4. ESG SOC factor portfolios

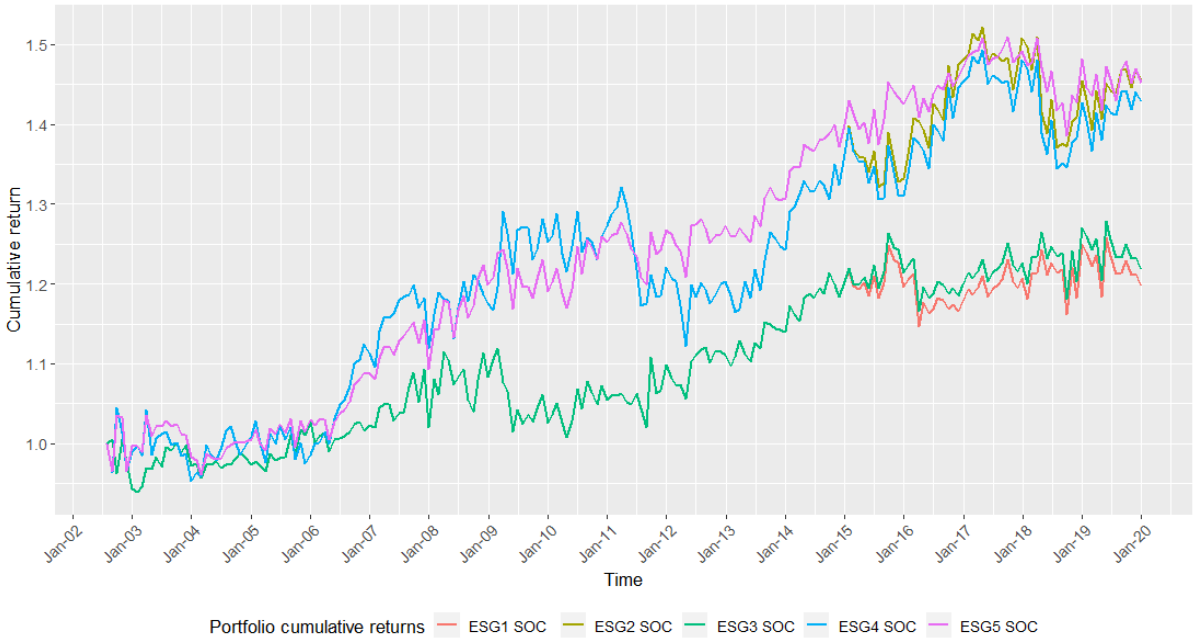


Figure 7: ESG SOC portfolios' cumulative returns
This figure presents cumulative returns for ESG SOC Factor portfolios created with decile sorts

Similarly to ESG Controversies and ESG Total, change-sorted portfolios outperformed level portfolios with ESG SOC. For change and combined factors (ESG1, ESG3 and ESG5) returns went hand in hand through the whole sample period, all ending up with a cumulative return of roughly 45 %. Level portfolios accumulated a return of roughly 20 %, following same trends with change and combined portfolios.

I find results from ESG SOC portfolios that are on average in line with positive coefficients from Market-to-book regressions. Only inconsistency comes from the time variation of returns, as ESG SOC's valuation coefficient was on a rapid decline during 2015-2018, but cumulative returns were still on the rise during 2015 and 2018. There is significantly positive alpha of 0.23 % in ESG1 (tercile, quartile, $p < 0.05$), alpha of 0.29 % and 0.25 % in ESG3 (tercile, quartile, $p < 0.05$) and alpha of 0.26 % in ESG5 (decile, $p < 0.05$), although the long-short portfolio raw return means are not significantly different from zero (table 44). ESG SOC portfolios exceed ESG Controversies portfolios in monthly alpha in both significance and level of returns, but ESG SOC portfolios are outperformed by ESG Total portfolios roughly by 10 basis points (significant ESG Total portfolio alphas range between 0.3 % to 0.4 %).

When looking at correlations between Factor returns and four-factor model terms, there is significant positive correlation in most portfolios with SMB term and significant and negative correlation with UMD term. Similarly to ESG Controversies, Total and ENV, there is significant and negative correlation with market returns. Monthly asset turnover,

mean ESG SOC rating and number of stocks (table 49) are again very similar to the previously analyzed portfolios: changes in rankings for SOC Scores are as common as for other scores.

Table 16: ESG SOC change (ESG1) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG1 tercile	ESG1 quartile	ESG1 quintile	ESG1 decile
	(1)	(2)	(3)	(4)
MKT	−0.2813	−0.2784	−0.2605	−0.2681
	t = −9.71***	t = −10.16***	t = −8.98***	t = −7.81***
SMB	0.0648	0.0389	−0.0159	−0.0447
	t = 0.84	t = 0.54	t = −0.21	t = −0.49
HML	−0.0155	−0.0248	−0.0429	−0.0108
	t = −0.21	t = −0.36	t = −0.59	t = −0.13
UMD	−0.0579	−0.0874	−0.1007	−0.0943
	t = −1.74*	t = −2.78***	t = −3.03***	t = −2.40**
Constant	0.0023	0.0023	0.0020	0.0023
	t = 2.05**	t = 2.17**	t = 1.72*	t = 1.67*
Observations	210	210	210	210
R^2	0.3369	0.3491	0.2987	0.2464
Adjusted R^2	0.3239	0.3364	0.2850	0.2317
Residual Std. Error (df = 205)	0.0160	0.0151	0.0160	0.0189
F Statistic (df = 4; 205)	26.0351***	27.4865***	21.8315***	16.7559***
*Note: Significance level denoted by * , ** and ****				*p<0.1; **p<0.05; ***p<0.01

Table 17: ESG SOC change accounting for level (ESG3) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG3 tercile	ESG3 quartile	ESG3 quintile	ESG3 decile
	(1)	(2)	(3)	(4)
MKT	−0.2808	−0.2795	−0.2616	−0.2684
	t = −10.03***	t = −10.14***	t = −9.02***	t = −7.82***
SMB	0.0650	0.0329	−0.0121	−0.0421
	t = 0.88	t = 0.45	t = −0.16	t = −0.46
HML	−0.0070	−0.0072	−0.0414	−0.0132
	t = −0.10	t = −0.10	t = −0.57	t = −0.15
UMD	−0.0705	−0.0848	−0.0988	−0.0937
	t = −2.20**	t = −2.69***	t = −2.97***	t = −2.38**
Constant	0.0029	0.0025	0.0021	0.0024
	t = 2.58**	t = 2.25**	t = 1.81*	t = 1.73*
Observations	210	210	210	210
R^2	0.3455	0.3484	0.3003	0.2469
Adjusted R^2	0.3327	0.3356	0.2867	0.2322
Residual Std. Error (df = 205)	0.0154	0.0152	0.0160	0.0189
F Statistic (df = 4; 205)	27.0518***	27.3981***	21.9981***	16.8041***
*Note: Significance level denoted by * , ** and ****				*p<0.1; **p<0.05; ***p<0.01

Table 18: ESG SOC change and level comnbined (ESG5) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG5 tercile	ESG5 quartile	ESG5 quintile	ESG5 decile
	(1)	(2)	(3)	(4)
MKT	−0.2756	−0.27	−0.2756	−0.2739
	t = −9.68***	t = −9.45***	t = −9.55***	t = −9.24***
SMB	0.1771	0.1638	0.1633	0.1834
	t = 2.35**	t = 2.16**	t = 2.14**	t = 2.34**
HML	−0.0027	−0.0094	0.0022	0.0370
	t = −0.04	t = −0.13	t = 0.03	t = 0.50
UMD	−0.0158	−0.0199	−0.0184	0.0110
	t = −0.48	t = −0.60	t = −0.56	t = 0.32
Constant	0.0021	0.0020	0.0021	0.0026
	t = 1.90*	t = 1.75*	t = 1.82*	t = 2.26**
Observations	210	210	210	210
R^2	0.3495	0.3369	0.3419	0.3420
Adjusted R^2	0.3368	0.3239	0.3291	0.3291
Residual Std. Error (df = 205)	0.0157	0.0158	0.0159	0.0164
F Statistic (df = 4; 205)	27.5366***	26.0371***	26.6288***	26.6354***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

5.3.5. ESG GOV factor portfolios

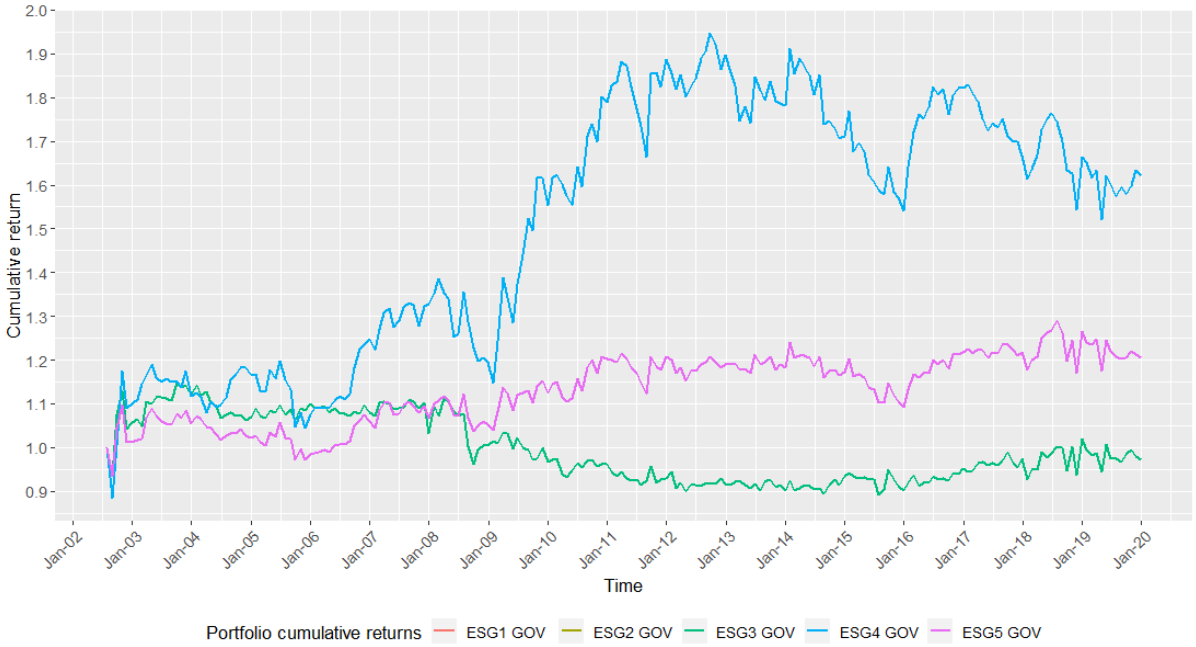


Figure 8: ESG GOV portfolios' cumulative returns
This figure presents cumulative returns for ESG GOV Factor portfolios created with decile sorts

For ESG GOV, both level approaches ESG1 and ESG3, are identical since virtually no companies exist in dataset that are included in the top decile of ESG GOV change and bottom decile of ESG GOV level. This naturally also goes for level approaches ESG2 and ESG4. Similarly to SOC, level factors outperform change factors. The difference is quite substantial, since ESG2 and ESG4 factors generated cumulative returns of around 95 % until second half of 2012, whereas change factors had a cumulative return of around -10 % during the same period. Since then, the gap has gotten smaller, but ESG2 and ESG4 sat at 67 % at the end of 2019, while change portfolios' cumulative returns were still below zero. There are no other significant correlations in four-factor model other than negative correlation with market returns.

No alphas of statistical significance are found from ESG GOV portfolios. Even with a positive and significant coefficient on valuation, no abnormal returns are gained through monthly screening of companies by ESG GOV Scores. Intuitively, any relevant news regarding company's governance should by default be priced more effectively due to its evident value-affecting nature. Whereas in ESG Total, ESG ENV and ESG SOC a lot of the information affecting the ratings come from annual reports, any new information regarding ESG GOV is usually due for immediate release (Board composition, Compensation, New CSR strategy, Shareholder rights, Takeover defenses etc.) and therefore makes it harder for asset managers to seize abnormal returns with a mechanical factor strategy based on governance ratings.

Monthly coefficient plot figure 3 also suggests that ESG GOV rating was already in stock prices during 2002-2009, as the monthly moving average of the coefficient was actually on a slight decline. From 2009 to mid 2014, there was again an increase in exponentially smoothed coefficient, which can be seen in rapidly accumulated Factor returns in ESG during 2009-2013. Market valuation coefficient was again on a decline during 2014-2019, and it is also visible in negative portfolio development during the same time period. High returns during 2009-2013 are not able to compensate for other less successful periods of time, and thus I find statistically insignificant alpha coefficient for ESG GOV.

6. Additional tests

6.1. Market valuation tests

To test how my results are in line with Serafeim's valuation results, I also run ESG Total and Controversies regression on U.S. only sample (table 19). The results are similar, although the coefficient on ESG Total is close to zero in Model 2, however negative (noted that the sample period in Serafeim's working paper is 2009 Jan - 2018 Jun). As discussed later in section 6.4, we see a trend of higher excess returns in the second half of the sample, meaning that results would be in line with Serafeimt's work also by using only the second half sample. ESG scores also have some variation depending on the rating agency, and Refinitiv and MSCI dataset do not have identical constituents, but based on my findings, outcomes are similar.

Additionally, I do robustness check where I run the same valuation regressions with lagged ESG scores as in Aouadi and Marsat (2018), but the coefficients remain virtually same and are not presented here. Logical explanation is that ESG scores remain static usually for 12 months before next update, hence lagged value predicts ESG score only once a year.

Table 19: Market-to-book total regressions: U.S. sample

	Dependent variable:		
	Log MTB		
	(1)	(2)	(3)
ESG Total Score‘	−0.0050 t = −36.0952***	−0.0054 t = −39.0676***	
ESG Controversies Score‘	0.0022 t = 22.77***		0.0026 t = 27.21***
Log MKT Cap previous month close	0.2013 t = 108.58***	0.1895 t = 106.24***	0.1662 t = 104.79***
Past return	0.3985 t = 57.44***	0.4049 t = 58.29***	0.4147 t = 59.61***
Sales growth	0.000001 t = 0.06	0.000000 t = 0.03	−0.000004 t = −0.30
ROE	0.0094 t = 14.16***	0.0098 t = 14.74***	0.0096 t = 14.41***
Leverage	0.0173 t = 94.24***	0.0172 t = 93.87***	0.0172 t = 93.47***
Observations	132,661	132,661	132,661
R^2	0.28	0.27	0.27
Adjusted R^2	0.27	0.27	0.27
Residual Std. Error	0.68 (df = 132426)	0.68 (df = 132427)	0.69 (df = 132427)
Note:			*p<0.1; **p<0.05; ***p<0.01

6.2. Size tests of excess returns

To test how the excess returns from portfolios differ based on firm size, I test returns from ESG change long-short portfolios (ESG1) separately for each size tercile portfolio. ESG change coefficients yielded the most significant results from previously presented Carhart regressions, and are therefore used for following robustness checks. In the following tables 20, 21, 22, 23, 24 I present Carhart regressions separately for small tercile, mid tercile, large tercile and , mid and large tercile combined for each ESG variable. Term "small tercile" might be misleading, since my sample is heavily tilted to large indices and large companies with average market cap of more than 10 bn USD. Small tercile here rather refers to smaller large cap and mid cap stocks, since Refinitiv ESG sample is built from common equity index constituents. As data is divided into three subsets based on size, statistical significance of returns in size portfolios is weakened due to weaker diversification resulting from lower number of stocks.

The small size tercile portfolio outperforms mid and large terciles with all ESG variables, measured by level of monthly alpha. However, Small tercile alpha is only statistically significant with ESG SOC and ESG GOV (p-level 0.05). The two portfolios outperform previously presented aggregate portfolios by a substantial margin: ESG SOC change Small tercile portfolio yielded monthly alpha of 0.80 %, whereas aggregate portfolio was 0.23 % (table 16). Alpha from Mid and Large tercile portfolio was -0.60 %. With ESG GOV, monthly alpha from Small tercile portfolio was 0.95 %, whereas aggregate portfolio return was only 0.14 % (see table 63 in appendix A). Mid and Large tercile combined yielded a statistically significant alpha of -0.26 %. These results are in line with Serafeim, who also finds larger coefficients for ESG Total Factor portfolios consisting of small companies compared to mid and large.

Even though alphas for size terciles are not statistically significant for ESG Controversies, Total and ENV, differences in monthly alpha coefficients are still evident. In ESG Controversies, Small tercile yielded an alpha of 0.4 % and Mid and Large tercile alpha of only 0.14 %. For ESG Total same coefficients were 0.26 % and 0.15 % and for ENV 0.43 % and -0.5 %, respectively.

Overall findings from size check suggest that abnormal returns found from aggregate ESG Total and SOC portfolios are explained by performance of Small tercile stocks. Additionally, with limiting sample to Small tercile, I find abnormal, statistically significant returns also with ESG GOV factor, which did not exist with the aggregate portfolios. Size differences are significantly larger for pillar scores than ESG Controversies and Total Scores.

I identify two possible explanations for size differences in excess returns, first being larger media and investor coverage of large companies' ESG performance. In this explanation,

ESG news are priced efficiently after announcement for large companies, and correspondingly ESG news for smaller companies might not be published and hence go unnoticed. Therefore, abnormal returns would exist for a mechanical, rating based investment strategy limited to smaller cap stocks, but not for Large cap stocks. Second explanation is that, as Refinitiv data brochure (Refinitiv, 2020a) suggests, any ESG events are more severe for large companies compared to smaller ones. Larger companies might suffer relatively more from negative events and gain relatively less from positive events compared to their smaller peers.

Size differences presented here have significant implications for future research: with ESG Scores gaining more traction, more Small and Mid cap stocks will be added to the ESG universe. For instance, MSCI Europe Small Mid Cap Index was added to the Refinitiv universe in 2019 (Refinitiv, 2020a). With larger sample, size differences between actual Small cap companies (Valuation less than 2 USD bn) and Mid and Large cap companies are possible and robust. It will be interesting to see whether ESG news coverage will increase for smaller companies and how that will affect return differences going forward. To confirm these two possible explanations for size differences, additional analysis of stock price reactions to ESG news announcements and rating releases with different size groups would be needed.

Table 20: ESG Controversies ESG change (ESG1) decile regressions, by size

	Dependent variable: ESG Controversies change factor monthly reutrn			
	Small tercile	Mid tercile	Large tercile	Mid and Large tercile
	(1)	(2)	(3)	(4)
MKT	−0.7037	−0.0084	−0.0527	−0.0305
	t = −7.56***	t = −0.23	t = −1.72*	t = −1.30
SMB	0.3900	−0.1192	−0.0585	−0.0889
	t = 1.58	t = −1.24	t = −0.72	t = −1.43
HML	0.0562	−0.0414	−0.1075	−0.0744
	t = 0.24	t = −0.46	t = −1.40	t = −1.27
UMD	0.0119	−0.0796	−0.0998	−0.0897
	t = 0.11	t = −1.91*	t = −2.84***	t = −3.34***
Constant	0.0040	0.0005	0.0023	0.0014
	t = 1.10	t = 0.33	t = 1.92*	t = 1.51
Observations	210	210	210	210
R^2	0.2558	0.0243	0.0475	0.0621
Adjusted R^2	0.2413	0.0053	0.0289	0.0438
Residual Std. Error (df = 205)	0.0514	0.0200	0.0169	0.0129
F Statistic (df = 4; 205)	17.6185***	1.2786	2.5565**	3.3927**
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 21: ESG Total change (ESG1) decile regressions, by size

	Dependent variable: Monthly excess return from Factor portfolio			
	Small tercile	Mid tercile	Large tercile	Mid and Large tercile
	(1)	(2)	(3)	(4)
MKT	−0.7789	−0.0611	0.0259	−0.0176
	t = −7.55***	t = −1.78*	t = 0.66	t = −0.78
SMB	0.5473	0.1865	−0.2018	−0.0077
	t = 2.00**	t = 2.05**	t = −1.95*	t = −0.13
HML	0.2661	0.0270	−0.0756	−0.0243
	t = 1.03	t = 0.31	t = −0.78	t = −0.43
UMD	0.0604	0.0533	−0.1134	−0.0301
	t = 0.51	t = 1.35	t = −2.54**	t = −1.16
Constant	0.0026	0.0018	0.0012	0.0015
	t = 0.63	t = 1.34	t = 0.81	t = 1.72*
Observations	210	210	210	210
R^2	0.2617	0.0486	0.0556	0.0077
Adjusted R^2	0.2473	0.0301	0.0372	−0.0117
Residual Std. Error (df = 205)	0.0569	0.0189	0.0215	0.0124
F Statistic (df = 4; 205)	18.1683***	2.6196**	3.0163**	0.3957
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 22: ESG ENV change (ESG1) decile regressions, by size

	Dependent variable: Monthly excess return from Factor portfolio			
	Small tercile	Mid tercile	Large tercile	Mid and Large tercile
	(1)	(2)	(3)	(4)
MKT	−0.8651	0.0875	−0.0481	0.0197
	t = −9.63***	t = 2.29**	t = −1.12	t = 0.68
SMB	0.4707	0.0970	−0.1473	−0.0252
	t = 1.98**	t = 0.96	t = −1.29	t = −0.33
HML	0.0364	0.0616	0.1089	0.0853
	t = 0.16	t = 0.65	t = 1.01	t = 1.18
UMD	−0.0264	0.0886	−0.0153	0.0366
	t = −0.26	t = 2.02**	t = −0.31	t = 1.10
Constant	0.0043	−0.0013	0.0003	−0.0005
	t = 1.20	t = −0.84	t = 0.15	t = −0.44
Observations	210	210	210	210
R^2	0.3507	0.0407	0.0202	0.0117
Adjusted R^2	0.3381	0.0219	0.0011	−0.0076
Residual Std. Error (df = 205)	0.0496	0.0210	0.0238	0.0160
F Statistic (df = 4; 205)	27.6859***	2.1725*	1.0569	0.6082
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 23: ESG SOC change (ESG1) decile regressions, by size

	Dependent variable: Monthly excess return from Factor portfolio			
	Small tercile	Mid tercile	Large tercile	Mid and Large tercile
	(1)	(2)	(3)	(4)
MKT	−0.8308	0.0203	0.0055	0.0129
	t = −9.43***	t = 0.52	t = 0.14	t = 0.43
SMB	0.3180	−0.2390	−0.2133	−0.2262
	t = 1.36	t = −2.32**	t = −2.12**	t = −2.85***
HML	0.1451	−0.0974	−0.0800	−0.0887
	t = 0.66	t = −1.00	t = −0.84	t = −1.18
UMD	−0.1073	−0.0576	−0.1183	−0.0880
	t = −1.06	t = −1.29	t = −2.72***	t = −2.56**
Constant	0.0080	−0.0004	−0.0008	−0.0006
	t = 2.29**	t = −0.24	t = −0.50	t = −0.48
Observations	210	210	210	210
R^2	0.3265	0.0377	0.0571	0.0714
Adjusted R^2	0.3133	0.0189	0.0387	0.0533
Residual Std. Error (df = 205)	0.0486	0.0215	0.0209	0.0165
F Statistic (df = 4; 205)	24.8395***	2.0073*	3.1019**	3.9415***
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 24: ESG GOV change (ESG1) decile regressions, by size

	Dependent variable: Monthly excess return from Factor portfolio			
	Small tercile	Mid tercile	Large tercile	Mid and Large tercile
	(1)	(2)	(3)	(4)
MKT	−0.8840	−0.0132	0.0403	0.0136
	t = −9.14***	t = −0.35	t = 1.04	t = 0.46
SMB	0.5869	0.1616	−0.1643	−0.0013
	t = 2.29**	t = 1.62	t = −1.60	t = −0.02
HML	0.0777	0.0535	−0.0046	0.0244
	t = 0.32	t = 0.57	t = −0.05	t = 0.33
UMD	−0.0917	0.0370	−0.0407	−0.0018
	t = −0.83	t = 0.85	t = −0.92	t = −0.05
Constant	0.0095	−0.0032	−0.0021	−0.0026
	t = 2.48**	t = −2.13**	t = −1.38	t = −2.29**
Observations	210	210	210	210
R^2	0.3155	0.0175	0.0230	0.0024
Adjusted R^2	0.3021	−0.0016	0.0039	−0.0170
Residual Std. Error (df = 205)	0.0534	0.0208	0.0214	0.0161
F Statistic (df = 4; 205)	23.6199***	0.9143	1.2047	0.1243
Note:				*p<0.1; **p<0.05; ***p<0.01

6.3. Value and equal weights

To test for robustness for my use of value weighted returns in my factor portfolios, I construct same aggregate portfolios with equal weights. For all ESG variables, implications remain unchanged, and all coefficients are very close to each other. Thus, I only present weighting differences for ESG controversies in this thesis (table 25). Monthly alpha and correlations with Carhart risk factors only differ from each by few decimals.

Table 25: ESG Controversies change decile (ESG1) regressions, value and equal weighted returns

	Dependent variable: Monthly excess return from Factor portfolio	
	Value weighted	Equal weighted
	(1)	(2)
MKT	−0.2547	−0.2535
	t = −7.61***	t = −7.26***
SMB	0.0707	0.0364
	t = 0.80	t = 0.39
HML	−0.0309	−0.0081
	t = −0.37	t = −0.09
UMD	−0.0558	−0.0415
	t = −1.45	t = −1.04
Constant	0.0023	0.0022
	t = 1.72*	t = 1.61
Observations	210	210
R^2	0.2370	0.2265
Adjusted R^2	0.2221	0.2114
Residual Std. Error (df = 205)	0.0185	0.0193
F Statistic (df = 4; 205)	15.9159***	15.0041***
Note:		*p<0.1; **p<0.05; ***p<0.01

6.4. Time and country differences

To test how consistent estimated alpha is over time and different markets, I construct ESG change (ESG1) decile portfolios with sub-samples where sample period is split in half (April 2011). These time period sub-samples are further split to U.S. and Europe sub-samples, since they are the two most important markets by a substantial margin in both first and second half of the sample. Based on the plotted time series earlier in section section 5.3, it seems that splitting the sample period in half at April 2011 gives a logical representation of differences between time periods, since there are significant changes in trends of time-series of returns around 2011. Following pages present sub-sample analysis for all different ESG Scores.

For ESG Controversies full sample (table 26), I find larger and statistically more significant alpha coefficient for the latter time period. Estimated full sample alpha is 0.23 % with a

p-level of 0.1, whereas May 2011 - Dec 2019 alpha is 0.43 % (p-level of 0.01) and Aug 2002 - Apr 2011 is 0.14 % (statistically insignificant). Same phenomenon is found both in U.S. and Europe sub-samples (see tables 27 and 28), but with U.S. sample coefficients are larger and statistically more significant. With Europe sample, ESG Controversies alpha was statistically insignificant with both time periods. In U.S. sample, difference is substantial: coefficient of alpha was -0.41 % in first time period, but 0.63 % (p-level 0.01) in second. Europe was a the driving force behind positive performance in first half, but U.S. has contributed more to the positive shift in the second half.

With ESG Total, I find a similar pattern with larger and more significant alpha in the second half in full sample and U.S. and EUR sub-samples (Tables 29, 30 and 31. Also in this case, Europe sub-sample exhibited a larger coefficient than U.S. in the first half, but U.S. exceeded full sample and Europe in the second half.

With ESG ENV, coefficient was negative for the full sample in the first half (no statistical significance), but positive and statistically significant in the second half (with a p-level of 0.05). On full sample period level, U.S. sample exhibited a positive coefficient of 0.3 % (p-level), but Europe a negative and statistically insignificant coefficient. Both U.S. and Europe were estimated with a positive and significant coefficient for ESG ENV in second half with a p-level of 0.01. These estimated coefficients were 0.64 % and 0.55 %, respectively. Interestingly, in Europe, coefficient was negative in the first half, whereas U.S. sample exhibits a positive coefficient for the full sample period.

For ESG SOC, I also find evidence of stronger returns in the second half. ESG SOC is positive in both first and second half for all Total, U.S. and Europe sample and most significant determinant for the statistically significant alpha from the aggregate portfolios seems to be U.S. companies' performance in the second half (coefficient of 0.67 % with p-level 0.01). These results contradict with the findings from monthly market valuation plot (figure 3). Valuation of ESG SOC rating was already stable between 2011 and 2014, and from 2014 onward it started a fast decline which ended in 2016, after which the valuation remained negative and stable. By logic, this drastic shift should have been visible in the ESG SOC factor, which actually performed better in the latter half. There is no clear explanation for this, but it is possible that companies with high ESG SOC are correlated with other value creating factors which delivered positive and significant alpha through the sample period, especially during the second half. Future research could look more thoroughly into divergences between market valuations and excess stock returns within ESG landscape.

ESG GOV differs from other scores in terms of Europe sub-sample. Total sample exhibits a positive coefficient through the whole sample and a larger and more statistically significant in the second half. In Europe, coefficient was positive in the first half, and

negative in the second half. U.S. market is a complete opposite of Europe in terms of ESG GOV. Coefficient was statistically insignificant and negative in the first half, but statistically significant and positive (coefficient of 0.74 % and p-level 0.01) in second. These contradicting trends in two markets are a key driver why the aggregate ESG GOV portfolio did not exhibit significant alpha during the full time period.

Overall my findings from sub-sample analysis reveal that the second half differs significantly from the first half and is the key contributing factor to all the significant alphas with the full sample period. Estimated coefficients for monthly alpha are significant and positive for full and U.S. samples in the second half with all ESG scores. Same holds for Europe, except for ESG GOV where Europe sample has a negative but statistically insignificant coefficient in the second half.

Generally speaking, Europe is the more important determinant for alpha in the first half, whereas in the second half U.S. sample presents larger coefficients and more statistical significance. Future studies can extend the analysis by splitting the dataset to even smaller time subsets. My time-series plots in section 5.3 section suggest that ESG Total's alpha has not yet disappeared, since returns were on a rising trend still at the end of my sample period, whereas for other variables trend during last two years has been more inconsistent. It will be interesting to see if ESG Momentum can be observed in the coming years. Additionally, with more and more emerging markets introduced to the sample, comparisons between emerging and developed markets can be further explored in future literature. It is also possible that new markets might still experience the same ESG Momentum patterns in the future, even if the effect disappears from U.S. and Europe.

Table 26: ESG Controversies sample period differences - ESG change (ESG1, deciles)

	Dependent variable: Monthly excess return from Factor portfolio		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.2547	−0.1956	−0.3107
	t = −7.61***	t = −3.87***	t = −7.30***
SMB	0.0707	0.0837	0.1023
	t = 0.80	t = 0.63	t = 0.93
HML	−0.0309	−0.2657	0.2250
	t = −0.37	t = −1.85*	t = 2.23**
UMD	−0.0558	−0.0341	−0.0135
	t = −1.45	−0.65	−0.21
Constant	0.0023	0.0014	0.0043
	t = 1.72*	t = 0.64	t = 2.93***
Observations	210	105	105
R^2	0.2370	0.2036	0.4061
Adjusted R^2	0.2221	0.1718	0.3823
Residual Std. Error	0.0185 (df = 205)	0.0216 (df = 100)	0.0140 (df = 100)
F Statistic	15.9159*** (df = 4; 205)	6.3915*** (df = 4; 100)	17.0921*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 27: ESG Controversies U.S. sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable: Monthly excess return from Factor portfolio		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.2470	−0.1431	−0.4071
	t = −4.04***	t = −1.41	t = −7.08***
SMB	−0.0259	−0.0010	0.0340
	t = −0.23	t = −0.01	t = 0.33
HML	−0.2020	−0.3607	−0.0211
	t = −1.87*	t = −1.99**	t = −0.20
UMD	−0.1160	−0.0892	−0.1336
	t = −2.11**	t = −1.11	−1.95*
Constant	0.0001	−0.0041	0.0063
	t = 0.05	t = −0.99	t = 3.33***
Observations	210	105	105
R^2	0.1029	0.0754	0.3615
Adjusted R^2	0.0854	0.0384	0.3359
Residual Std. Error	0.0324 (df = 205)	0.0416 (df = 100)	0.0179 (df = 100)
F Statistic	5.8786*** (df = 4; 205)	2.0385* (df = 4; 100)	14.1535*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 28: ESG Controversies EUR sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.2086	−0.1468	−0.3089
	t = −4.99***	−2.31**	t = −5.81***
SMB	0.1264	0.2287	−0.0248
	t = 1.32	t = 1.53	t = −0.22
HML	−0.0771	−0.2402	0.0497
	t = −0.62	t = −1.05	t = 0.35
UMD	0.0325	0.0641	0.0013
	t = 0.59	t = 0.85	t = 0.01
Constant	0.0020	0.0021	0.0033
	t = 1.01	t = 0.61	t = 1.40
Observations	210	105	105
R^2	0.1753	0.1438	0.2972
Adjusted R^2	0.1592	0.1096	0.2691
Residual Std. Error	0.0268 (df = 205)	0.0316 (df = 100)	0.0209 (df = 100)
F Statistic	10.8919*** (df = 4; 205)	4.1989*** (df = 4; 100)	10.5711*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 29: ESG Total sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.2970	−0.2214	−0.3938
	t = −8.36***	t = −3.99***	−9.39***
SMB	0.2186	0.2893	0.1126
	t = 2.32**	t = 2.00**	t = 1.04
HML	−0.0199	−0.2348	0.1263
	t = −0.22	t = −1.49	t = 1.27
UMD	−0.0181	0.0168	−0.0359
	t = −0.44	t = 0.29	t = −0.57
Constant	0.0037	0.0037	0.0049
	t = 2.66***	t = 1.54	t = 3.36***
Observations	210	105	105
R^2	0.2869	0.2233	0.5085
Adjusted R^2	0.2730	0.1923	0.4889
Residual Std. Error	0.0196 (df = 205)	0.0237 (df = 100)	0.0137 (df = 100)
F Statistic	20.6205*** (df = 4; 205)	7.1891*** (df = 4; 100)	25.8674*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 30: ESG Total U.S. sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.4135	−0.3369	−0.5503
	t = −7.84***	t = −3.92***	t = −9.72***
SMB	0.0565	−0.0578	0.2614
	t = 0.57	t = −0.36	t = 2.60**
HML	−0.0038	−0.0596	−0.0050
	t = −0.04	t = −0.39	t = −0.05
UMD	0.0204	0.0570	−0.0741
	t = 0.43	t = 0.84	t = −1.20
Constant	0.0022	0.00001	0.0065
	t = 1.09	t = 0.004	t = 3.51***
Observations	210	105	105
R^2	0.2826	0.2287	0.5055
Adjusted R^2	0.2686	0.1979	0.4857
Residual Std. Error	0.0280 (df = 205)	0.0351 (df = 100)	0.0177 (df = 100)
F Statistic	20.1860*** (df = 4; 205)	7.4131*** (df = 4; 100)	25.5550*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 31: ESG Total EUR sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.1816	−0.1086	−0.2941
	t = −4.66***	t = −1.74*	t = −6.95***
SMB	0.0416	0.0233	0.0265
	t = 0.47	t = 0.16	t = 0.29
HML	0.0366	−0.0854	0.0990
	t = 0.33	t = −0.38	t = 0.88
UMD	−0.0528	0.0072	−0.1788
	t = −1.03	t = 0.10	t = −2.40**
Constant	0.0025	0.0016	0.0051
	t = 1.33	t = 0.48	t = 2.76***
Observations	210	105	105
R^2	0.1076	0.0522	0.3329
Adjusted R^2	0.0902	0.0142	0.3063
Residual Std. Error	0.0250 (df = 205)	0.0311 (df = 100)	0.0166 (df = 100)
F Statistic	6.1794*** (df = 4; 205)	1.3758 (df = 4; 100)	12.4779*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 32: ESG ENV sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.2750	−0.1824	−0.4147
	t = −7.76***	−3.52***	t = −8.68***
SMB	0.1400	0.1505	0.1247
	t = 1.49	t = 1.11	t = 1.01
HML	0.0689	−0.1027	0.1177
	t = 0.78	t = −0.70	t = 1.04
UMD	0.0156	0.0766	−0.1039
	t = 0.38	t = 1.43	t = −1.45
Constant	0.0011	−0.0002	0.0042
	t = 0.78	t = −0.08	t = 2.52**
Observations	210	105	105
R^2	0.2703	0.2139	0.4553
Adjusted R^2	0.2560	0.1824	0.4335
Residual Std. Error	0.0195 (df = 205)	0.0221 (df = 100)	0.0157 (df = 100)
F Statistic	18.9821*** (df = 4; 205)	6.8016*** (df = 4; 100)	20.8982*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 33: ESG ENV U.S. sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.3723	−0.2484	−0.5742
	t = −8.24***	t = −3.54***	t = −10.81***
SMB	0.1722	0.1245	0.3089
	t = 2.03**	t = 0.94	t = 3.28***
HML	0.0761	−0.0129	0.1298
	t = 0.96	t = −0.10	t = 1.33
UMD	−0.0735	−0.0584	−0.0579
	t = −1.81*	t = −1.05	t = −0.91
Constant	0.0030	0.0014	0.0064
	t = 1.76*	t = 0.50	t = 3.69***
Observations	210	105	105
R^2	0.2527	0.1194	0.5710
Adjusted R^2	0.2381	0.0841	0.5539
Residual Std. Error	0.0240 (df = 205)	0.0287 (df = 100)	0.0166 (df = 100)
F Statistic	17.3288*** (df = 4; 205)	3.3884** (df = 4; 100)	33.2770*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 34: ESG ENV EUR sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.1859	−0.0549	−0.3731
	t = −4.67***	t = −0.97	t = −7.85***
SMB	0.1414	0.2427	−0.0232
	t = 1.56	t = 1.81*	t = −0.23
HML	−0.1753	−0.6935	0.2098
	t = −1.49	−3.40***	t = 1.67*
UMD	−0.0483	0.0611	−0.2367
	t = −0.92	t = 0.91	−2.83***
Constant	−0.0002	−0.0010	0.0055
	t = −0.13	t = −0.32	t = 2.67***
Observations	210	105	105
R^2	0.1431	0.1752	0.3869
Adjusted R^2	0.1264	0.1422	0.3624
Residual Std. Error	0.0255 (df = 205)	0.0283 (df = 100)	0.0187 (df = 100)
F Statistic	8.5588*** (df = 4; 205)	5.3100*** (df = 4; 100)	15.7785*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 35: ESG SOC sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.2681	−0.1613	−0.3843
	t = −7.81***	t = −3.54***	t = −7.68***
SMB	−0.0447	−0.1101	0.1224
	t = −0.49	t = −0.92	t = 0.94
HML	−0.0108	−0.3192	0.3333
	t = −0.13	t = −2.46**	t = 2.80***
UMD	−0.0943	−0.0745	0.0142
	t = −2.40**	t = −1.58	t = 0.19
Constant	0.0023	0.0019	0.0043
	t = 1.67*	t = 0.97	t = 2.46**
Observations	210	105	105
R^2	0.2464	0.2251	0.4459
Adjusted R^2	0.2317	0.1941	0.4237
Residual Std. Error	0.0189 (df = 205)	0.0195 (df = 100)	0.0164 (df = 100)
F Statistic	16.7559*** (df = 4; 205)	7.2627*** (df = 4; 100)	20.1180*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 36: ESG SOC U.S. sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT_US	−0.2801	−0.1486	−0.4643
	t = −6.27***	t = −2.43**	t = −7.24***
SMB_US	−0.1378	−0.2923	0.1722
	t = −1.64	t = −2.52**	t = 1.51
HML_US	−0.0604	−0.2256	0.1641
	t = −0.77	t = −2.07**	t = 1.39
UMD_US	−0.0863	−0.0731	−0.0168
	t = −2.15**	t = −1.51	t = −0.22
Constant	0.0018	−0.0002	0.0067
	t = 1.05	t = −0.09	t = 3.17***
Observations	210	105	105
R^2	0.2156	0.2190	0.3926
Adjusted R^2	0.2003	0.1877	0.3683
Residual Std. Error	0.0237 (df = 205)	0.0250 (df = 100)	0.0200 (df = 100)
F Statistic	14.0836*** (df = 4; 205)	7.0096*** (df = 4; 100)	16.1575*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 37: ESG SOC EUR sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.2215	−0.1592	−0.3067
	t = −5.86***	t = −3.00***	t = −5.69***
SMB	0.0191	0.0985	−0.0796
	t = 0.22	t = 0.79	t = −0.69
HML	−0.0655	−0.3751	0.2373
	t = −0.59	t = −1.97*	t = 1.66*
UMD	−0.0244	0.0087	−0.0246
	t = −0.49	t = 0.14	t = −0.26
Constant	0.0020	0.0015	0.0046
	t = 1.09	t = 0.51	t = 1.95*
Observations	210	105	105
R^2	0.1863	0.1866	0.2731
Adjusted R^2	0.1705	0.1540	0.2440
Residual Std. Error	0.0243 (df = 205)	0.0264 (df = 100)	0.0212 (df = 100)
F Statistic	11.7363*** (df = 4; 205)	5.7334*** (df = 4; 100)	9.3926*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 38: ESG GOV sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.2853	−0.1791	−0.4190
	t = −6.97***	t = −2.95***	t = −7.89***
SMB	0.1945	0.2103	0.2039
	t = 1.79*	t = 1.33	t = 1.48
HML	0.0422	−0.2408	0.2752
	t = 0.41	t = −1.39	t = 2.18**
UMD	−0.0318	0.0122	−0.0347
	t = −0.67	t = 0.19	t = −0.44
Constant	0.0014	0.0006	0.0040
	t = 0.87	t = 0.22	t = 2.17**
Observations	210	105	105
R^2	0.2100	0.1433	0.4372
Adjusted R^2	0.1946	0.1091	0.4147
Residual Std. Error	0.0226 (df = 205)	0.0259 (df = 100)	0.0174 (df = 100)
F Statistic	13.6213*** (df = 4; 205)	4.1823*** (df = 4; 100)	19.4197*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 39: ESG GOV U.S. sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT_US	−0.3619	−0.2213	−0.5927
	t = −8.13***	t = −3.80***	t = −8.71***
SMB_US	0.0370	−0.0481	0.2530
	t = 0.44	t = −0.44	t = 2.09**
HML_US	0.0566	−0.0757	0.1594
	t = 0.72	t = −0.73	t = 1.28
UMD_US	−0.0832	−0.0499	−0.1172
	t = −2.08**	t = −1.08	t = −1.44
Constant	0.0011	−0.0023	0.0074
	t = 0.67	t = −0.97	t = 3.31***
Observations	210	105	105
R^2	0.2592	0.1765	0.4663
Adjusted R^2	0.2447	0.1436	0.4449
Residual Std. Error	0.0236 (df = 205)	0.0238 (df = 100)	0.0212 (df = 100)
F Statistic	17.9315*** (df = 4; 205)	5.3588*** (df = 4; 100)	21.8403*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 40: ESG GOV EUR sub-sample analysis - ESG change (ESG1, deciles)

	Dependent variable:		
	Full sample	Aug 2002 - Apr 2011	May 2011 - Dec 2019
	(1)	(2)	(3)
MKT	−0.2204	−0.1907	−0.2655
	t = −4.52***	t = −2.37**	t = −5.39***
SMB	0.1081	0.1813	0.0218
	t = 0.97	t = 0.96	t = 0.21
HML	0.1675	0.0777	0.2515
	t = 1.16	t = 0.27	t = 1.93*
UMD	−0.0759	−0.0900	0.0294
	t = −1.18	−0.95	t = 0.34
Constant	0.0016	0.0035	−0.0008
	t = 0.68	t = 0.8	t 1= −0.36
Observations	210	105	105
R^2	0.1003	0.0627	0.2706
Adjusted R^2	0.0828	0.0252	0.2414
Residual Std. Error	0.0313 (df = 205)	0.0400 (df = 100)	0.0193 (df = 100)
F Statistic	5.7163*** (df = 4; 205)	1.6727 (df = 4; 100)	9.2740*** (df = 4; 100)
Note:			*p<0.1; **p<0.05; ***p<0.01

7. Conclusion, limitations and implications for future research

In this paper, I have studied ESG Total Score's, ESG Controversies Score's and ESG pillar scores' effect on firm valuation and excess stock returns. I find statistically significant effect on market valuation from all five ESG scores. For ESG Total, effect in the full sample is significant and negative, with most logical explanation of irrelevance of ESG performance to majority of industries and companies. Based on my results, using scarce resources to improve overall ESG performance has destroyed shareholder value for an average company between 2002-2019. My findings are limited to the sample period of 2002-2019, and it is likely that the valuation coefficients continue to experience shifts and changes in the order of importance. ESG Total Score's valuation has been on a rapid rise since 2015, and if the trend continues, we might enter a period of time where ESG activities are a significant source of value creation for the majority of companies.

Effects of Controversies Score and different pillars are widely positive and significant. ESG Controversies Score, ESG SOC and ESG GOV are positive and statistically significant determinants of firm valuation, whereas only ESG ENV has a significant and negative effect. Valuation coefficients on natural logarithm of Market-to-book ratio range between -0.0019 from ESG Total and 0.0047 from ESG GOV, which means that 10 point increase in ESG Total Score reduces valuation by 1.9 %, whereas 10 point increase in GOV Score increases valuation by 4.7 %.

For managers seeking to extract value from ESG activities in their respective companies, my results have practical implications. With overall ESG performance's value-destroying nature, companies need to plan carefully how they allocate their resources to ESG projects. Valuation coefficients reveal that good governance should be a top priority for an average company above social and environmental responsibility related projects. As overall ESG performance is penalized during my sample period, it is important not to lose focus, and rather target good performance only in ESG metrics that matter to the firm's respective industry and are actively screened by important stakeholders.

ESG Factor long-short portfolios yielded significant and positive alpha for ESG Total Score and SOC Score during the full sample period, and rest of the ESG scores have statistically significant and positive abnormal returns in the second half of the sample period. From my robustness checks presented in section 6, I find out that smaller companies in the sample as well as U.S. companies have been important drivers of positive returns in Factor portfolios.

Practical implications for asset managers are the following. Positive and statistically significant abnormal returns can be generated with all the Refinitiv ESG scores and thus

attractive investment products that cater to investors' ESG needs are easy to create. Regarding which methods in portfolio construction should be preferred, 3 out 5 ESG scores presented higher returns for change-sorted portfolios. On average, returns tend to be higher for portfolios sorted with deciles. Given sufficient enough data, even stricter sorting approaches could be used to extract even better risk-adjusted returns without sacrificing too much diversification. As the abnormal returns were higher for smaller companies in the sample, asset managers and investors should pay close attention to mid and small cap firms introduced to the ESG universe.

7.1. Limitations of the thesis

Overall, my thesis follows a robust and transparent methodology, but there are some important considerations concerning interpretation of the results that the reader needs to bear in mind.

First, as discussed in section 3, Refinitiv has made some adjustments to the ESG rating methods during the latter years of the sample period. For instance, ESG Controversies variable was introduced in 2018, and thus values given in the dataset for prior years were not actually available at the time. Methodologies for pillar and overall score have also changed, but regardless of whether ratings have been updated with new methodology for historical years or not, I assume that the data gives an objective view on the top and bottom performers on a given date that corresponds to information that was available at the time.

Second, sample is limited to large cap companies due to ESG ratings being available for only constituents of major equity indices. Additionally, data is heavily tilted towards U.S. and European markets, and generalisation of results to developing markets is not fully feasible.

Third, I realize that importance of ESG performance varies a lot based on industry and company. For instance, ESG Total Score might be a lot more relevant metric for an energy company compared to an information service company. Importance of an ESG topic can also vary within industry, as for one company in a specific country, valuation of ESG performance could be completely different from a company in the same industry, but a different market. Thus, my findings present only the average effects of ESG ratings for an average company. Additionally, as the time variation plot presented in part 5.2 suggests, valuation of ESG scores do not stay constant over time. For this reason, valuation of ESG activities in the coming years could be totally different from what is presented here based on this sample.

7.2. Implications for future research

Even with a wide scope covered in this thesis, there are still numerous additional research possibilities within ESG investing landscape. Studying valuation effects separately for different ESG score levels would provide empirical proof for the reasoning of the differences we see in valuation coefficients and excess stock returns. Another open question is the predicting power of ESG Total Score on ESG Controversies Score - do we actually see companies end up in fewer scandals regardless of their efforts?

Future papers could also address whether my findings are consistent across all other ESG rating agency data. Additionally, more thorough analysis of specific industries could lead to even more profitable strategies. Looking into investment strategies with higher frequency than one month is also a topic that has not been widely studied. Studying stock returns around ESG rating and news releases is also important in understanding how fast sustainability is priced. It is still an open question how passive or active should ESG strategies be in order to find the optimal point of high returns and low transaction costs.

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A. Appendix

List of Tables in Appendix

Table 41: ESG Controversies portfolio summary statistics

Portfolio	N	Mean	St.dev	T-stat
ESG1 tercile top	210	0.0118	0.0534	3.2115
ESG1 tercile bottom	210	0.0116	0.0455	3.6988
ESG1 tercile long-short	210	0.0002	0.0173	0.1865
ESG1 quartile top	210	0.0119	0.0538	3.2144
ESG1 quartile bottom	210	0.0115	0.0465	3.5695
ESG1 quartile long-short	210	0.0005	0.0170	0.3978
ESG1 quintile top	210	0.0122	0.0544	3.2619
ESG1 quintile bottom	210	0.0114	0.0468	3.5431
ESG1 quintile long-short	210	0.0008	0.0190	0.6091
ESG1 decile top	210	0.0122	0.0573	3.0809
ESG1 decile bottom	210	0.0108	0.0498	3.1459
ESG1 decile long-short	210	0.0014	0.0209	0.9522
ESG2 tercile top	210	0.0117	0.0500	3.3893
ESG2 tercile bottom	210	0.0117	0.0474	3.5927
ESG2 tercile long-short	210	-0.0001	0.0166	-0.0449
ESG2 quartile top	210	0.0116	0.0497	3.3993
ESG2 quartile bottom	210	0.0112	0.0485	3.3605
ESG2 quartile long-short	210	0.0004	0.0174	0.3333
ESG2 quintile top	210	0.0118	0.0493	3.4834
ESG2 quintile bottom	210	0.0107	0.0498	3.1066
ESG2 quintile long-short	210	0.0012	0.0182	0.9360
ESG2 decile top	210	0.0122	0.0511	3.4642
ESG2 decile bottom	210	0.0120	0.0540	3.2211
ESG2 decile long-short	210	0.0002	0.0223	0.1286
ESG3 tercile top	210	0.0115	0.0531	3.1510
ESG3 tercile bottom	210	0.0113	0.0470	3.4755
ESG3 tercile long-short	210	0.0003	0.0169	0.2269
ESG3 quartile top	210	0.0119	0.0539	3.1937
ESG3 quartile bottom	210	0.0112	0.0474	3.4189
ESG3 quartile long-short	210	0.0007	0.0174	0.5890
ESG3 quintile top	210	0.0124	0.0545	3.2916
ESG3 quintile bottom	210	0.0113	0.0474	3.4529
ESG3 quintile long-short	210	0.0011	0.0191	0.8237
ESG3 decile top	210	0.0122	0.0573	3.0784
ESG3 decile bottom	210	0.0108	0.0498	3.1393
ESG3 decile long-short	210	0.0014	0.0208	0.9618
ESG4 tercile top	210	0.0115	0.0506	3.2937
ESG4 tercile bottom	210	0.0115	0.0475	3.5150
ESG4 tercile long-short	210	-0.00001	0.0169	-0.0113
ESG4 quartile top	210	0.0115	0.0503	3.3156
ESG4 quartile bottom	210	0.0112	0.0486	3.3386
ESG4 quartile long-short	210	0.0003	0.0177	0.2465
ESG4 quintile top	210	0.0117	0.0497	3.4205
ESG4 quintile bottom	210	0.0108	0.0501	3.1304
ESG4 quintile long-short	210	0.0009	0.0186	0.7187
ESG4 decile top	210	0.0122	0.0511	3.4572
ESG4 decile bottom	210	0.0120	0.0540	3.2211
ESG4 decile long-short	210	0.0002	0.0224	0.1130
ESG5 tercile top	210	0.0114	0.0528	3.1415
ESG5 tercile bottom	210	0.0114	0.0464	3.5720
ESG5 tercile long-short	210	0.00001	0.0163	0.0094
ESG5 quartile top	210	0.0117	0.0528	3.2203
ESG5 quartile bottom	210	0.0114	0.0470	3.5215
ESG5 quartile long-short	210	0.0003	0.0159	0.2793
ESG5 quintile top	210	0.0119	0.0530	3.2547
ESG5 quintile bottom	210	0.0112	0.0474	3.4239
ESG5 quintile long-short	210	0.0007	0.0173	0.5919
ESG5 decile top	210	0.0118	0.0542	3.1696
ESG5 decile bottom	210	0.0111	0.0511	3.1424
ESG5 decile long-short	210	0.0008	0.0182	0.6087

Table 42: ESG Total portfolio summary statistics

Portfolio	N	Mean	St.dev	T-stat
ESG1 tercile top	210	0.0124	0.0539	3.3192
ESG1 tercile bottom	210	0.0110	0.0448	3.5712
ESG1 tercile long-short	210	0.0013	0.0193	0.9962
ESG1 quartile top	210	0.0129	0.0549	3.4162
ESG1 quartile bottom	210	0.0115	0.0447	3.7184
ESG1 quartile long-short	210	0.0015	0.0213	0.9982
ESG1 quintile top	210	0.0131	0.0557	3.3987
ESG1 quintile bottom	210	0.0112	0.0455	3.5753
ESG1 quintile long-short	210	0.0018	0.0217	1.2235
ESG1 decile top	210	0.0131	0.0591	3.2186
ESG1 decile bottom	210	0.0104	0.0484	3.1010
ESG1 decile long-short	210	0.0028	0.0230	1.7418
ESG2 tercile top	210	0.0118	0.0560	3.0575
ESG2 tercile bottom	210	0.0111	0.0447	3.5843
ESG2 tercile long-short	210	0.0008	0.0204	0.5385
ESG2 quartile top	210	0.0123	0.0557	3.2081
ESG2 quartile bottom	210	0.0111	0.0435	3.6853
ESG2 quartile long-short	210	0.0013	0.0212	0.8741
ESG2 quintile top	210	0.0122	0.0560	3.1634
ESG2 quintile bottom	210	0.0111	0.0429	3.7602
ESG2 quintile long-short	210	0.0011	0.0223	0.7061
ESG2 decile top	210	0.0138	0.0562	3.5474
ESG2 decile bottom	210	0.0114	0.0417	3.9611
ESG2 decile long-short	210	0.0024	0.0267	1.2811
ESG3 tercile top	210	0.0123	0.0547	3.2651
ESG3 tercile bottom	210	0.0109	0.0453	3.4836
ESG3 tercile long-short	210	0.0014	0.0200	1.0352
ESG3 quartile top	210	0.0126	0.0555	3.3034
ESG3 quartile bottom	210	0.0110	0.0456	3.4996
ESG3 quartile long-short	210	0.0016	0.0207	1.1506
ESG3 quintile top	210	0.0127	0.0559	3.2896
ESG3 quintile bottom	210	0.0110	0.0460	3.4585
ESG3 quintile long-short	210	0.0017	0.0213	1.1536
ESG3 decile top	210	0.0129	0.0592	3.1640
ESG3 decile bottom	210	0.0101	0.0485	3.0266
ESG3 decile long-short	210	0.0028	0.0231	1.7555
ESG4 tercile top	210	0.0121	0.0566	3.1090
ESG4 tercile bottom	210	0.0110	0.0441	3.6256
ESG4 tercile long-short	210	0.0011	0.0220	0.7289
ESG4 quartile top	210	0.0124	0.0560	3.1982
ESG4 quartile bottom	210	0.0111	0.0432	3.7182
ESG4 quartile long-short	210	0.0013	0.0218	0.8530
ESG4 quintile top	210	0.0124	0.0558	3.2105
ESG4 quintile bottom	210	0.0110	0.0427	3.7464
ESG4 quintile long-short	210	0.0013	0.0224	0.8616
ESG4 decile top	210	0.0135	0.0563	3.4880
ESG4 decile bottom	210	0.0113	0.0417	3.9309
ESG4 decile long-short	210	0.0022	0.0268	1.2073
ESG5 tercile top	210	0.0121	0.0566	3.1025
ESG5 tercile bottom	210	0.0112	0.0448	3.6329
ESG5 tercile long-short	210	0.0009	0.0219	0.5825
ESG5 quartile top	210	0.0123	0.0574	3.1158
ESG5 quartile bottom	210	0.0111	0.0449	3.5998
ESG5 quartile long-short	210	0.0012	0.0235	0.7416
ESG5 quintile top	210	0.0122	0.0579	3.0391
ESG5 quintile bottom	210	0.0109	0.0452	3.5085
ESG5 quintile long-short	210	0.0012	0.0245	0.7202
ESG5 decile top	210	0.0131	0.0592	3.2031
ESG5 decile bottom	210	0.0107	0.0463	3.3544
ESG5 decile long-short	210	0.0024	0.0255	1.3495

Table 43: ESG ENV portfolio summary statistics

Portfolio	N	Mean	St.dev	T-stat
ESG1 tercile top	210	0.0120	0.0529	3.2982
ESG1 tercile bottom	210	0.0113	0.0447	3.6708
ESG1 tercile long-short	210	0.0007	0.0191	0.5395
ESG1 quartile top	210	0.0120	0.0534	3.2632
ESG1 quartile bottom	210	0.0115	0.0449	3.7192
ESG1 quartile long-short	210	0.0005	0.0199	0.3600
ESG1 quintile top	210	0.0118	0.0540	3.1678
ESG1 quintile bottom	210	0.0118	0.0456	3.7464
ESG1 quintile long-short	210	0.00003	0.0208	0.0205
ESG1 decile top	210	0.0126	0.0551	3.3220
ESG1 decile bottom	210	0.0122	0.0461	3.8184
ESG1 decile long-short	210	0.0005	0.0227	0.3134
ESG2 tercile top	210	0.0124	0.0563	3.1895
ESG2 tercile bottom	210	0.0122	0.0457	3.8764
ESG2 tercile long-short	210	0.0002	0.0211	0.1127
ESG2 quartile top	210	0.0120	0.0570	3.0441
ESG2 quartile bottom	210	0.0119	0.0462	3.7195
ESG2 quartile long-short	210	0.0001	0.0231	0.0785
ESG2 quintile top	210	0.0119	0.0577	2.9857
ESG2 quintile bottom	210	0.0120	0.0459	3.7959
ESG2 quintile long-short	210	-0.0001	0.0242	-0.0861
ESG2 decile top	210	0.0132	0.0584	3.2802
ESG2 decile bottom	210	0.0121	0.0450	3.8927
ESG2 decile long-short	210	0.0011	0.0276	0.5849
ESG3 tercile top	210	0.0119	0.0538	3.1975
ESG3 tercile bottom	210	0.0113	0.0452	3.6174
ESG3 tercile long-short	210	0.0006	0.0194	0.4448
ESG3 quartile top	210	0.0120	0.0538	3.2404
ESG3 quartile bottom	210	0.0116	0.0448	3.7357
ESG3 quartile long-short	210	0.0005	0.0201	0.3363
ESG3 quintile top	210	0.0118	0.0540	3.1618
ESG3 quintile bottom	210	0.0117	0.0451	3.7531
ESG3 quintile long-short	210	0.0001	0.0208	0.0652
ESG3 decile top	210	0.0126	0.0551	3.3175
ESG3 decile bottom	210	0.0121	0.0460	3.8281
ESG3 decile long-short	210	0.0005	0.0227	0.3070
ESG4 tercile top	210	0.0132	0.0566	3.3753
ESG4 tercile bottom	210	0.0123	0.0457	3.8882
ESG4 tercile long-short	210	0.0009	0.0220	0.5968
ESG4 quartile top	210	0.0124	0.0573	3.1394
ESG4 quartile bottom	210	0.0119	0.0463	3.7338
ESG4 quartile long-short	210	0.0005	0.0233	0.2928
ESG4 quintile top	210	0.0119	0.0573	3.0210
ESG4 quintile bottom	210	0.0120	0.0459	3.7882
ESG4 quintile long-short	210	-0.0001	0.0238	-0.0315
ESG4 decile top	210	0.0132	0.0582	3.2954
ESG4 decile bottom	210	0.0121	0.0450	3.8880
ESG4 decile long-short	210	0.0012	0.0276	0.6091
ESG5 tercile top	210	0.0126	0.0548	3.3389
ESG5 tercile bottom	210	0.0116	0.0455	3.7124
ESG5 tercile long-short	210	0.0010	0.0204	0.7006
ESG5 quartile top	210	0.0127	0.0551	3.3445
ESG5 quartile bottom	210	0.0116	0.0457	3.6876
ESG5 quartile long-short	210	0.0011	0.0209	0.7539
ESG5 quintile top	210	0.0127	0.0551	3.3391
ESG5 quintile bottom	210	0.0118	0.0456	3.7407
ESG5 quintile long-short	210	0.0009	0.0211	0.6430
ESG5 decile top	210	0.0134	0.0548	3.5336
ESG5 decile bottom	210	0.0119	0.0452	3.8234
ESG5 decile long-short	210	0.0014	0.0219	0.9476

Table 44: ESG SOC portfolio summary statistics

Portfolio	N	Mean	St.dev	T-stat
ESG1 tercile top	210	0.0123	0.0550	3.2337
ESG1 tercile bottom	210	0.0110	0.0454	3.5148
ESG1 tercile long-short	210	0.0013	0.0194	0.9435
ESG1 quartile top	210	0.0121	0.0547	3.1959
ESG1 quartile bottom	210	0.0109	0.0465	3.4056
ESG1 quartile long-short	210	0.0011	0.0186	0.8847
ESG1 quintile top	210	0.0121	0.0544	3.2195
ESG1 quintile bottom	210	0.0113	0.0462	3.5466
ESG1 quintile long-short	210	0.0008	0.0189	0.6023
ESG1 decile top	210	0.0120	0.0551	3.1536
ESG1 decile bottom	210	0.0109	0.0476	3.3165
ESG1 decile long-short	210	0.0011	0.0216	0.7325
ESG2 tercile top	210	0.0127	0.0545	3.3895
ESG2 tercile bottom	210	0.0118	0.0457	3.7387
ESG2 tercile long-short	210	0.0010	0.0201	0.6922
ESG2 quartile top	210	0.0123	0.0533	3.3488
ESG2 quartile bottom	210	0.0114	0.0447	3.7090
ESG2 quartile long-short	210	0.0009	0.0211	0.6112
ESG2 quintile top	210	0.0121	0.0536	3.2566
ESG2 quintile bottom	210	0.0110	0.0442	3.5879
ESG2 quintile long-short	210	0.0011	0.0220	0.7243
ESG2 decile top	210	0.0123	0.0536	3.3233
ESG2 decile bottom	210	0.0102	0.0442	3.3330
ESG2 decile long-short	210	0.0021	0.0244	1.2638
ESG3 tercile top	210	0.0126	0.0560	3.2527
ESG3 tercile bottom	210	0.0108	0.0468	3.3550
ESG3 tercile long-short	210	0.0017	0.0189	1.3239
ESG3 quartile top	210	0.0121	0.0552	3.1788
ESG3 quartile bottom	210	0.0109	0.0470	3.3430
ESG3 quartile long-short	210	0.0013	0.0187	0.9795
ESG3 quintile top	210	0.0121	0.0545	3.2168
ESG3 quintile bottom	210	0.0112	0.0463	3.5067
ESG3 quintile long-short	210	0.0009	0.0189	0.6832
ESG3 decile top	210	0.0120	0.0551	3.1475
ESG3 decile bottom	210	0.0108	0.0476	3.2834
ESG3 decile long-short	210	0.0012	0.0216	0.7859
ESG4 tercile top	210	0.0128	0.0546	3.3918
ESG4 tercile bottom	210	0.0116	0.0451	3.7167
ESG4 tercile long-short	210	0.0012	0.0206	0.8425
ESG4 quartile top	210	0.0123	0.0534	3.3416
ESG4 quartile bottom	210	0.0114	0.0446	3.7018
ESG4 quartile long-short	210	0.0009	0.0209	0.6355
ESG4 quintile top	210	0.0120	0.0537	3.2323
ESG4 quintile bottom	210	0.0110	0.0442	3.5922
ESG4 quintile long-short	210	0.0010	0.0217	0.6789
ESG4 decile top	210	0.0122	0.0537	3.2943
ESG4 decile bottom	210	0.0102	0.0442	3.3328
ESG4 decile long-short	210	0.0020	0.0244	1.2097
ESG5 tercile top	210	0.0127	0.0548	3.3657
ESG5 tercile bottom	210	0.0114	0.0459	3.5998
ESG5 tercile long-short	210	0.0013	0.0193	0.9948
ESG5 quartile top	210	0.0125	0.0545	3.3288
ESG5 quartile bottom	210	0.0113	0.0457	3.5948
ESG5 quartile long-short	210	0.0012	0.0193	0.8827
ESG5 quintile top	210	0.0127	0.0542	3.3938
ESG5 quintile bottom	210	0.0114	0.0454	3.6517
ESG5 quintile long-short	210	0.0013	0.0194	0.9337
ESG5 decile top	210	0.0128	0.0538	3.4623
ESG5 decile bottom	210	0.0108	0.0462	3.3976
ESG5 decile long-short	210	0.0020	0.0200	1.4617

Table 45: ESG GOV portfolio summary statistics

Portfolio	N	Mean	St.dev	T-stat
ESG1 tercile top	210	0.0123	0.0559	3.1836
ESG1 tercile bottom	210	0.0118	0.0458	3.7286
ESG1 tercile long-short	210	0.0005	0.0202	0.3549
ESG1 quartile top	210	0.0128	0.0568	3.2633
ESG1 quartile bottom	210	0.0120	0.0459	3.8059
ESG1 quartile long-short	210	0.0007	0.0218	0.4973
ESG1 quintile top	210	0.0130	0.0576	3.2679
ESG1 quintile bottom	210	0.0124	0.0458	3.9328
ESG1 quintile long-short	210	0.0006	0.0237	0.3404
ESG1 decile top	210	0.0126	0.0595	3.0635
ESG1 decile bottom	210	0.0121	0.0477	3.6727
ESG1 decile long-short	210	0.0005	0.0252	0.2877
ESG2 tercile top	210	0.0123	0.0557	3.1932
ESG2 tercile bottom	210	0.0107	0.0454	3.4270
ESG2 tercile long-short	210	0.0015	0.0261	0.8541
ESG2 quartile top	210	0.0122	0.0563	3.1436
ESG2 quartile bottom	210	0.0103	0.0454	3.3006
ESG2 quartile long-short	210	0.0019	0.0283	0.9604
ESG2 quintile top	210	0.0128	0.0571	3.2452
ESG2 quintile bottom	210	0.0104	0.0456	3.3014
ESG2 quintile long-short	210	0.0024	0.0299	1.1634
ESG2 decile top	210	0.0136	0.0589	3.3453
ESG2 decile bottom	210	0.0104	0.0436	3.4582
ESG2 decile long-short	210	0.0032	0.0361	1.2810
ESG3 tercile top	210	0.0125	0.0569	3.1764
ESG3 tercile bottom	210	0.0118	0.0458	3.7216
ESG3 tercile long-short	210	0.0007	0.0214	0.4874
ESG3 quartile top	210	0.0128	0.0571	3.2400
ESG3 quartile bottom	210	0.0121	0.0460	3.7975
ESG3 quartile long-short	210	0.0007	0.0218	0.4707
ESG3 quintile top	210	0.0129	0.0577	3.2357
ESG3 quintile bottom	210	0.0124	0.0458	3.9172
ESG3 quintile long-short	210	0.0005	0.0237	0.3111
ESG3 decile top	210	0.0126	0.0595	3.0635
ESG3 decile bottom	210	0.0121	0.0477	3.6727
ESG3 decile long-short	210	0.0005	0.0252	0.2877
ESG4 tercile top	210	0.0125	0.0557	3.2375
ESG4 tercile bottom	210	0.0106	0.0450	3.4089
ESG4 tercile long-short	210	0.0019	0.0273	0.9896
ESG4 quartile top	210	0.0123	0.0564	3.1545
ESG4 quartile bottom	210	0.0103	0.0452	3.2914
ESG4 quartile long-short	210	0.0020	0.0287	1.0169
ESG4 quintile top	210	0.0127	0.0570	3.2339
ESG4 quintile bottom	210	0.0103	0.0456	3.2811
ESG4 quintile long-short	210	0.0024	0.0298	1.1739
ESG4 decile top	210	0.0136	0.0589	3.3453
ESG4 decile bottom	210	0.0104	0.0436	3.4582
ESG4 decile long-short	210	0.0032	0.0361	1.2810
ESG5 tercile top	210	0.0127	0.0555	3.3137
ESG5 tercile bottom	210	0.0115	0.0442	3.7879
ESG5 tercile long-short	210	0.0011	0.0221	0.7506
ESG5 quartile top	210	0.0128	0.0556	3.3398
ESG5 quartile bottom	210	0.0115	0.0438	3.8003
ESG5 quartile long-short	210	0.0013	0.0230	0.8331
ESG5 quintile top	210	0.0129	0.0561	3.3448
ESG5 quintile bottom	210	0.0115	0.0437	3.8276
ESG5 quintile long-short	210	0.0014	0.0238	0.8512
ESG5 decile top	210	0.0131	0.0565	3.3592
ESG5 decile bottom	210	0.0116	0.0431	3.9040
ESG5 decile long-short	210	0.0015	0.0249	0.8582

Table 46: ESG Controversies portfolio characteristics

Portfolio	Average monthly turnover ratio	Average number of stocks	Average ESG Controversies rating
ESG1 tercile top	0.13	1,051.35	56.51
ESG1 tercile bottom	0.13	1,009.02	36.53
ESG1 quartile top	0.13	756.48	56.61
ESG1 quartile bottom	0.14	758.58	31.04
ESG1 quintile top	0.13	608.50	56.71
ESG1 quintile bottom	0.14	604.91	25.89
ESG1 decile top	0.14	304.88	58.67
ESG1 decile bottom	0.15	297.60	12.62
ESG2 tercile top	0.10	1,055.86	63.43
ESG2 tercile bottom	0.09	1,007.80	27.06
ESG2 quartile top	0.10	781.68	64.38
ESG2 quartile bottom	0.10	765	18.06
ESG2 quintile top	0.11	617.04	65.09
ESG2 quintile bottom	0.10	609.79	12.17
ESG2 decile top	0.11	314.98	67.02
ESG2 decile bottom	0.11	299.98	5.29
ESG3 tercile top	0.13	873.86	62.36
ESG3 tercile bottom	0.12	842.04	32.18
ESG3 quartile top	0.13	660.33	62.10
ESG3 quartile bottom	0.13	688.05	28.03
ESG3 quintile top	0.13	553.50	60.77
ESG3 quintile bottom	0.13	576.40	23.92
ESG3 decile top	0.14	305.62	58.73
ESG3 decile bottom	0.14	299.10	12.50
ESG4 tercile top	0.11	894.67	63.49
ESG4 tercile bottom	0.11	824.30	25.70
ESG4 quartile top	0.11	711.67	64.43
ESG4 quartile bottom	0.11	664.09	17.38
ESG4 quintile top	0.11	587.83	65.13
ESG4 quintile bottom	0.11	550.74	11.82
ESG4 decile top	0.11	314.66	67.02
ESG4 decile bottom	0.11	299.08	5.28
ESG5 tercile top	0.11	1,102.41	62.04
ESG5 tercile bottom	0.11	1,076.11	35.63
ESG5 quartile top	0.12	877.79	62.71
ESG5 quartile bottom	0.12	869.39	30.53
ESG5 quintile top	0.12	723.28	63.19
ESG5 quintile bottom	0.12	700.47	24.74
ESG5 decile top	0.13	454.57	63.85
ESG5 decile bottom	0.13	412.64	10.74

Table 47: ESG Total portfolio characteristics

Portfolio	Average monthly turnover ratio	Average number of stocks	Average ESG Total rating
ESG1 tercile top	0.11	1,009.91	56.18
ESG1 tercile bottom	0.12	980.04	47.96
ESG1 quartile top	0.12	742.66	57.09
ESG1 quartile bottom	0.12	742.95	47.53
ESG1 quintile top	0.12	594.29	57.72
ESG1 quintile bottom	0.12	594.34	47.24
ESG1 decile top	0.13	297.43	59.14
ESG1 decile bottom	0.13	297.42	46.54
ESG2 tercile top	0.08	1,009.20	69.84
ESG2 tercile bottom	0.08	979.60	32.85
ESG2 quartile top	0.09	742.41	73.07
ESG2 quartile bottom	0.08	742.45	30.29
ESG2 quintile top	0.09	594.08	75.07
ESG2 quintile bottom	0.08	594.00	28.46
ESG2 decile top	0.11	297.38	80.06
ESG2 decile bottom	0.09	297.33	24.05
ESG3 tercile top	0.11	785.41	61.24
ESG3 tercile bottom	0.12	708.17	40.68
ESG3 quartile top	0.12	651.28	59.86
ESG3 quartile bottom	0.12	609.92	43.07
ESG3 quintile top	0.12	552.67	59.28
ESG3 quintile bottom	0.12	521.94	44.31
ESG3 decile top	0.13	294.65	59.34
ESG3 decile bottom	0.13	288.82	45.81
ESG4 tercile top	0.10	737.33	70.25
ESG4 tercile bottom	0.09	755.10	32.19
ESG4 quartile top	0.10	609.38	73.37
ESG4 quartile bottom	0.09	651.07	29.95
ESG4 quintile top	0.10	521.67	75.26
ESG4 quintile bottom	0.09	552.38	28.27
ESG4 decile top	0.11	288.78	80.11
ESG4 decile bottom	0.09	294.55	24.02
ESG5 tercile top	0.10	795.64	67.57
ESG5 tercile bottom	0.11	1,079.17	46.10
ESG5 quartile top	0.11	683.79	68.60
ESG5 quartile bottom	0.11	906.42	44.46
ESG5 quintile top	0.11	595.48	69.34
ESG5 quintile bottom	0.12	772.83	43.25
ESG5 decile top	0.13	357.86	71.05
ESG5 decile bottom	0.12	438.87	40.24

Table 48: ESG ENV portfolio characteristics

Portfolio	Average monthly turnover ratio	Average number of stocks	Average ESG ENV rating
ESG1 tercile top	0.11	1,009.92	62.34
ESG1 tercile bottom	0.12	985.22	49.48
ESG1 quartile top	0.11	742.50	62.75
ESG1 quartile bottom	0.12	745.43	51.62
ESG1 quintile top	0.12	594.14	63.62
ESG1 quintile bottom	0.13	595.92	52.43
ESG1 decile top	0.13	297.31	66.57
ESG1 decile bottom	0.13	297.40	48.97
ESG2 tercile top	0.08	1,009.11	89.17
ESG2 tercile bottom	0.08	979.94	15.78
ESG2 quartile top	0.08	742.31	92.02
ESG2 quartile bottom	0.08	743.74	13.61
ESG2 quintile top	0.08	594.08	93.07
ESG2 quintile bottom	0.08	595.86	12.71
ESG2 decile top	0.10	297.78	94.49
ESG2 decile bottom	0.10	308.26	11.76
ESG3 tercile top	0.11	874.34	67.73
ESG3 tercile bottom	0.12	681.06	35.32
ESG3 quartile top	0.11	725.45	63.60
ESG3 quartile bottom	0.12	593.66	44.88
ESG3 quintile top	0.12	593.47	63.69
ESG3 quintile bottom	0.12	518.00	49.36
ESG3 decile top	0.13	297.31	66.57
ESG3 decile bottom	0.13	293.01	48.68
ESG4 tercile top	0.11	704.95	89.56
ESG4 tercile bottom	0.08	844.37	14.89
ESG4 quartile top	0.10	590.54	92.17
ESG4 quartile bottom	0.08	726.69	13.51
ESG4 quintile top	0.09	516.16	93.08
ESG4 quintile bottom	0.08	595.19	12.71
ESG4 decile top	0.10	293.40	94.49
ESG4 decile bottom	0.10	308.26	11.76
ESG5 tercile top	0.10	946.05	82.30
ESG5 tercile bottom	0.11	881.86	35.37
ESG5 quartile top	0.11	827.75	83.02
ESG5 quartile bottom	0.11	823.22	35.17
ESG5 quintile top	0.11	720.21	83.35
ESG5 quintile bottom	0.11	743.91	35.22
ESG5 decile top	0.12	415.90	83.44
ESG5 decile bottom	0.13	443.35	35.09

Table 49: ESG SOC portfolio characteristics

Portfolio	Average monthly turnover ratio	Average number of stocks	Average ESG SOC rating
ESG1 tercile top	0.11	1,009.58	59.16
ESG1 tercile bottom	0.12	980.21	51.22
ESG1 quartile top	0.12	742.43	60.97
ESG1 quartile bottom	0.12	742.74	51.57
ESG1 quintile top	0.12	594.10	62.15
ESG1 quintile bottom	0.13	594.21	51.51
ESG1 decile top	0.13	297.36	65.71
ESG1 decile bottom	0.13	297.44	49.25
ESG2 tercile top	0.08	1,009.12	87.18
ESG2 tercile bottom	0.08	979.44	17.05
ESG2 quartile top	0.09	742.32	90.56
ESG2 quartile bottom	0.08	742.30	13.30
ESG2 quintile top	0.09	594	92.17
ESG2 quintile bottom	0.09	594.00	11.24
ESG2 decile top	0.11	297.45	94.95
ESG2 decile bottom	0.09	297.52	7.94
ESG3 tercile top	0.12	794.02	67.84
ESG3 tercile bottom	0.12	630.15	37.47
ESG3 quartile top	0.12	694.08	63.42
ESG3 quartile bottom	0.12	577.77	45.33
ESG3 quintile top	0.12	586.59	62.59
ESG3 quintile bottom	0.13	517.26	48.80
ESG3 decile top	0.13	297.36	65.71
ESG3 decile bottom	0.13	292.59	49.05
ESG4 tercile top	0.11	659.06	87.73
ESG4 tercile bottom	0.10	763.89	15.43
ESG4 quartile top	0.11	577.35	90.86
ESG4 quartile bottom	0.09	693.94	12.88
ESG4 quintile top	0.10	517.05	92.26
ESG4 quintile bottom	0.09	586.49	11.17
ESG4 decile top	0.11	292.60	94.95
ESG4 decile bottom	0.09	297.52	7.94
ESG5 tercile top	0.11	869.05	80.43
ESG5 tercile bottom	0.11	840.33	39.62
ESG5 quartile top	0.11	754.01	81.25
ESG5 quartile bottom	0.12	769.67	38.64
ESG5 quintile top	0.11	659.49	81.66
ESG5 quintile bottom	0.12	688.16	37.81
ESG5 decile top	0.12	390.80	82.07
ESG5 decile bottom	0.13	420.58	35.40

Table 50: ESG GOV portfolio characteristics

Portfolio	Average monthly turnover ratio	Average number of stocks	Average ESG GOV rating
ESG1 tercile top	0.11	1,009.27	61.20
ESG1 tercile bottom	0.12	979.81	49.64
ESG1 quartile top	0.12	742.39	63.26
ESG1 quartile bottom	0.12	742.48	49.99
ESG1 quintile top	0.12	594.07	64.17
ESG1 quintile bottom	0.12	594.13	49.39
ESG1 decile top	0.13	297.33	66.10
ESG1 decile bottom	0.13	297.30	46.06
ESG2 tercile top	0.08	1,009.20	84.06
ESG2 tercile bottom	0.08	979.48	14.66
ESG2 quartile top	0.08	742.36	87.05
ESG2 quartile bottom	0.08	742.23	10.26
ESG2 quintile top	0.09	594.07	88.69
ESG2 quintile bottom	0.08	593.96	7.92
ESG2 decile top	0.10	297.43	92.24
ESG2 decile bottom	0.09	297.47	4.02
ESG3 tercile top	0.11	827.09	70.18
ESG3 tercile bottom	0.12	720.99	38.62
ESG3 quartile top	0.12	703.51	65.65
ESG3 quartile bottom	0.12	651.83	45.55
ESG3 quintile top	0.12	589.50	64.46
ESG3 quintile bottom	0.12	561.34	47.47
ESG3 decile top	0.13	297.33	66.10
ESG3 decile bottom	0.13	297.30	46.06
ESG4 tercile top	0.10	750.37	84.89
ESG4 tercile bottom	0.09	797.30	12.91
ESG4 quartile top	0.10	651.71	87.40
ESG4 quartile bottom	0.08	703.35	9.84
ESG4 quintile top	0.09	561.29	88.84
ESG4 quintile bottom	0.08	589.39	7.88
ESG4 decile top	0.10	297.43	92.24
ESG4 decile bottom	0.09	297.47	4.02
ESG5 tercile top	0.10	913.65	79.04
ESG5 tercile bottom	0.11	1,017.47	39.59
ESG5 quartile top	0.11	799.08	80.13
ESG5 quartile bottom	0.11	908.35	37.46
ESG5 quintile top	0.11	700.90	80.78
ESG5 quintile bottom	0.12	791.31	35.85
ESG5 decile top	0.12	407.44	82.15
ESG5 decile bottom	0.13	448.66	32.20

Table 51: ESG Controversies level (ESG2) Factor portfolio returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG2 tercile	ESG2 quartile	ESG2 quintile	ESG2 decile
	(1)	(2)	(3)	(4)
MKT	−0.2284	−0.2400	−0.2219	−0.2197
	t = −9.17***	t = −9.05***	t = −7.62***	t = −5.88***
SMB	−0.0004	0.0685	0.0719	0.0803
	t = −0.01	t = 0.98	t = 0.93	t = 0.81
HML	−0.1420	−0.1147	−0.1395	−0.1346
	t = −2.28**	t = −1.73*	t = −1.92*	t = −1.44
UMD	−0.0727	−0.0791	−0.0846	−0.0633
	t = −2.55**	t = −2.60***	t = −2.53**	t = −1.48
Constant	0.0009	0.0014	0.0021	0.0010
	t = 0.90	t = 1.34	t = 1.83*	t = 0.68
Observations	210	210	210	210
R^2	0.3300	0.3081	0.2427	0.1637
Adjusted R^2	0.3170	0.2945	0.2279	0.1474
Residual Std. Error (df = 205)	0.0137	0.0146	0.0161	0.0206
F Statistic (df = 4; 205)	25.2482***	22.8161***	16.4222***	10.0325***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 52: ESG Controversies levels accounting for change (ESG4) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG4 tercile	ESG4 quartile	ESG4 quintile	ESG4 decile
	(1)	(2)	(3)	(4)
MKT	−0.2283	−0.2471	−0.2323	−0.2207
	t = −8.93***	t = −9.22***	t = −7.88***	t = −5.89***
SMB	0.0071	0.0714	0.0781	0.0826
	t = 0.10	t = 1.01	t = 1.00	t = 0.83
HML	−0.1590	−0.1308	−0.1432	−0.1410
	t = −2.49**	t = −1.95*	t = −1.94*	t = −1.51
UMD	−0.0750	−0.0855	−0.0929	−0.0651
	t = −2.56**	t = −2.78***	t = −2.75***	t = −1.52
Constant	0.0009	0.0014	0.0020	0.0010
	t = 0.94	t = 1.32	t = 1.68*	t = 0.68
Observations	210	210	210	210
R^2	0.3208	0.3173	0.2533	0.1648
Adjusted R^2	0.3075	0.3040	0.2387	0.1485
Residual Std. Error (df = 205)	0.0141	0.0148	0.0163	0.0207
F Statistic (df = 4; 205)	24.2010***	23.8244***	17.3815***	10.1128***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 53: ESG Controversies change and level combined (ESG5) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG5 tercile	ESG5 quartile	ESG5 quintile	ESG5 decile
	(1)	(2)	(3)	(4)
MKT	−0.2281	−0.2307	−0.2336	−0.2442
	t = −9.20***	t = −9.74***	t = −8.83***	t = −8.64***
SMB	0.0196	0.0636	0.0479	0.0403
	t = 0.30	t = 1.01	t = 0.68	t = 0.54
HML	−0.0743	−0.1046	−0.1059	−0.1058
	t = −1.20	t = −1.77*	t = −1.60	t = −1.50
UMD	−0.0852	−0.0834	−0.0743	−0.0891
	t = −3.00***	t = −3.07***	t = −2.45**	t = −2.75***
Constant	0.0009	0.0013	0.0016	0.0018
	t = 0.95	t = 1.34	t = 1.56	t = 1.65
Observations	210	210	210	210
R^2	0.3102	0.3368	0.2991	0.2867
Adjusted R^2	0.2967	0.3239	0.2854	0.2728
Residual Std. Error (df = 205)	0.0137	0.0131	0.0146	0.0156
F Statistic (df = 4; 205)	23.0442***	26.0312***	21.8684***	20.6009***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 54: ESG Total level (ESG2) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG2 tercile	ESG2 quartile	ESG2 quintile	ESG2 decile
	(1)	(2)	(3)	(4)
MKT	−0.2481	−0.2414	−0.2177	−0.2612
	t = −7.55***	t = −6.98***	t = −5.82***	t = −5.86***
SMB	0.1817	0.1563	0.1973	0.1979
	t = 2.09**	t = 1.71*	t = 1.99**	t = 1.68*
HML	−0.0218	0.0009	0.0163	0.1983
	t = −0.27	t = 0.01	t = 0.17	t = 1.78*
UMD	−0.0527	−0.0463	−0.0197	−0.0085
	t = −1.40	t = −1.17	t = −0.46	t = −0.17
Constant	0.0016	0.0020	0.0015	0.0028
	t = 1.22	t = 1.46	t = 1.02	t = 1.61
Observations	210	210	210	210
R^2	0.2318	0.2045	0.1599	0.1680
Adjusted R^2	0.2168	0.1890	0.1435	0.1518
Residual Std. Error (df = 205)	0.0181	0.0191	0.0206	0.0246
F Statistic (df = 4; 205)	15.4607***	13.1763***	9.7514***	10.3475***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 55: ESG Total level accounting for change (ESG4) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG4 tercile	ESG4 quartile	ESG4 quintile	ESG4 decile
	(1)	(2)	(3)	(4)
MKT	−0.2549	−0.2427	−0.2207	−0.2621
	t = −7.17***	t = −6.78***	t = −5.90***	t = −5.86***
SMB	0.2167	0.1857	0.2237	0.2022
	t = 2.30**	t = 1.96*	t = 2.26**	t = 1.71*
HML	−0.0141	0.0025	0.0330	0.2065
	t = −0.16	t = 0.03	t = 0.35	t = 1.85*
UMD	−0.0362	−0.0360	−0.0032	−0.0033
	t = −0.89	t = −0.88	t = −0.07	t = −0.06
Constant	0.0019	0.0020	0.0017	0.0027
	t = 1.34	t = 1.39	t = 1.13	t = 1.52
Observations	210	210	210	210
R^2	0.2203	0.1992	0.1712	0.1705
Adjusted R^2	0.2051	0.1836	0.1550	0.1544
Residual Std. Error (df = 205)	0.0196	0.0198	0.0206	0.0247
F Statistic (df = 4; 205)	14.4782***	12.7511***	10.5848***	10.5375***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 56: ESG ENV change (ESG1) Factor portfolio returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG1 tercile	ESG1 quartile	ESG1 quintile	ESG1 decile
	(1)	(2)	(3)	(4)
MKT	−0.2568	−0.2608	−0.2764	−0.2750
	t = −8.94***	t = −8.66***	t = −8.80***	t = −7.76***
SMB	0.1512	0.1530	0.1766	0.1400
	t = 1.99**	t = 1.92*	t = 2.12**	t = 1.49
HML	−0.0056	0.0211	0.0541	0.0689
	t = −0.08	t = 0.28	t = 0.69	t = 0.78
UMD	0.0051	0.0179	0.0095	0.0156
	t = 0.16	t = 0.52	t = 0.26	t = 0.38
Constant	0.0013	0.0010	0.0007	0.0011
	t = 1.15	t = 0.87	t = 0.54	t = 0.78
Observations	210	210	210	210
R^2	0.3274	0.3199	0.3186	0.2703
Adjusted R^2	0.3143	0.3066	0.3053	0.2560
Residual Std. Error (df = 205)	0.0158	0.0166	0.0173	0.0195
F Statistic (df = 4; 205)	24.9450***	24.1071***	23.9601***	18.9821***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 57: ESG ENV level (ESG2) Factor portfolio returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG2 tercile	ESG2 quartile	ESG2 quintile	ESG2 decile
	(1)	(2)	(3)	(4)
MKT	−0.2202	−0.2117	−0.1996	−0.2112
	t = −6.33***	t = −5.42***	t = −4.79***	t = −4.47***
SMB	0.1705	0.2177	0.2294	0.2945
	t = 1.85*	t = 2.11**	t = 2.08**	t = 2.35**
HML	−0.0435	−0.0311	−0.0378	−0.1115
	t = −0.50	t = −0.32	t = −0.36	t = −0.94
UMD	−0.0167	−0.0136	−0.0155	0.0234
	t = −0.42	t = −0.30	t = −0.32	t = 0.43
Constant	0.0006	0.0005	0.0002	0.0014
	t = 0.47	t = 0.34	t = 0.11	t = 0.75
Observations	210	210	210	210
R^2	0.1886	0.1476	0.1200	0.1284
Adjusted R^2	0.1728	0.1310	0.1029	0.1114
Residual Std. Error (df = 205)	0.0192	0.0215	0.0230	0.0261
F Statistic (df = 4; 205)	11.9144***	8.8745***	6.9911***	7.5510***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 58: ESG ENV change accounting for level (ESG3) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG3 tercile	ESG3 quartile	ESG3 quintile	ESG3 decile
	(1)	(2)	(3)	(4)
MKT	−0.2463	−0.2531	−0.2695	−0.2727
	t = −8.26***	t = −8.23***	t = −8.45***	t = −7.66***
SMB	0.1468	0.1497	0.1686	0.1339
	t = 1.86*	t = 1.84*	t = 2.00**	t = 1.42
HML	−0.0092	0.0290	0.0649	0.0706
	t = −0.12	t = 0.38	t = 0.81	t = 0.79
UMD	0.0049	0.0227	0.0108	0.0160
	t = 0.14	t = 0.64	t = 0.30	t = 0.39
Constant	0.0011	0.0009	0.0007	0.0011
	t = 0.95	t = 0.76	t = 0.53	t = 0.75
Observations	210	210	210	210
R^2	0.2938	0.3010	0.3017	0.2657
Adjusted R^2	0.2800	0.2873	0.2880	0.2514
Residual Std. Error (df = 205)	0.0165	0.0170	0.0176	0.0196
F Statistic (df = 4; 205)	21.3184***	22.0668***	22.1386***	18.5469***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 59: ESG ENV level accounting for change (ESG4) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG4 tercile	ESG4 quartile	ESG4 quintile	ESG4 decile
	(1)	(2)	(3)	(4)
MKT	−0.2324	−0.2229	−0.2051	−0.2114
	t = −6.49***	t = −5.73***	t = −5.05***	t = −4.49***
SMB	0.1963	0.2450	0.2403	0.2952
	t = 2.07**	t = 2.38**	t = 2.23**	t = 2.37**
HML	−0.0400	−0.0390	−0.0419	−0.1127
	t = −0.45	t = −0.40	t = −0.41	t = −0.96
UMD	0.0065	−0.0058	−0.0099	0.0218
	t = 0.16	t = −0.13	t = −0.21	t = 0.40
Constant	0.0014	0.0009	0.0003	0.0014
	t = 0.96	t = 0.59	t = 0.18	t = 0.78
Observations	210	210	210	210
R^2	0.2081	0.1668	0.1344	0.1289
Adjusted R^2	0.1927	0.1505	0.1175	0.1119
Residual Std. Error (df = 205)	0.0198	0.0215	0.0224	0.0260
F Statistic (df = 4; 205)	13.4708***	10.2573***	7.9594***	7.5826***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 60: ESG ENV change and level combined (ESG5) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG5 tercile	ESG5 quartile	ESG5 quintile	ESG5 decile
	(1)	(2)	(3)	(4)
MKT	−0.2489	−0.2495	−0.2468	−0.2314
	t = −7.90***	t = −7.68***	t = −7.42***	t = −6.57***
SMB	0.2253	0.2415	0.2332	0.1617
	t = 2.70***	t = 2.81***	t = 2.65***	t = 1.73*
HML	0.0013	0.0179	0.0123	0.0045
	t = 0.02	t = 0.22	t = 0.15	t = 0.05
UMD	0.0291	0.0360	0.0294	0.0426
	t = 0.81	t = 0.97	t = 0.77	t = 1.05
Constant	0.0014	0.0014	0.0013	0.0017
	t = 1.12	t = 1.13	t = 1.00	t = 1.20
Observations	210	210	210	210
R^2	0.2911	0.2833	0.2659	0.2306
Adjusted R^2	0.2772	0.2693	0.2516	0.2155
Residual Std. Error (df = 205)	0.0174	0.0179	0.0183	0.0194
F Statistic (df = 4; 205)	21.0423***	20.2538***	18.5666***	15.3567***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 61: ESG SOC level (ESG2) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG2 tercile	ESG2 quartile	ESG2 quintile	ESG2 decile
	(1)	(2)	(3)	(4)
MKT	−0.2430	−0.2504	−0.2542	−0.2305
	t = −7.57***	t = −7.40***	t = −7.15***	t = −5.68***
SMB	0.2105	0.2376	0.2183	0.2542
	t = 2.48**	t = 2.65***	t = 2.32**	t = 2.37**
HML	−0.0326	−0.0108	−0.0046	0.0953
	t = −0.41	t = −0.13	t = −0.05	t = 0.94
UMD	−0.0324	−0.0389	−0.0391	0.0222
	t = −0.88	t = −1.00	t = −0.96	t = 0.48
Constant	0.0017	0.0016	0.0019	0.0023
	t = 1.30	t = 1.22	t = 1.33	t = 1.46
Observations	210	210	210	210
R^2	0.2423	0.2307	0.2179	0.1721
Adjusted R^2	0.2275	0.2157	0.2026	0.1559
Residual Std. Error (df = 205)	0.0177	0.0187	0.0196	0.0224
F Statistic (df = 4; 205)	16.3872***	15.3706***	14.2767***	10.6535***
*Note: Significance level denoted by * , ** and ****				*p<0.1; **p<0.05; ***p<0.01

Table 62: ESG SOC level accounting for change (ESG4) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG4 tercile	ESG4 quartile	ESG4 quintile	ESG4 decile
	(1)	(2)	(3)	(4)
MKT	−0.2535	−0.2521	−0.2490	−0.2295
	t = −7.83***	t = −7.53***	t = −7.04***	t = −5.65***
SMB	0.2261	0.2489	0.2069	0.2472
	t = 2.64***	t = 2.81***	t = 2.21**	t = 2.30**
HML	−0.0326	−0.0146	−0.0016	0.0988
	t = −0.40	t = −0.17	t = −0.02	t = 0.97
UMD	−0.0187	−0.0425	−0.0420	0.0212
	t = −0.50	t = −1.11	t = −1.04	t = 0.46
Constant	0.0019	0.0017	0.0018	0.0023
	t = 1.48	t = 1.28	t = 1.26	t = 1.40
Observations	210	210	210	210
R^2	0.2621	0.2371	0.2108	0.1697
Adjusted R^2	0.2477	0.2222	0.1954	0.1535
Residual Std. Error (df = 205)	0.0178	0.0185	0.0195	0.0224
F Statistic (df = 4; 205)	18.2000***	15.9284***	13.6895***	10.4719***
*Note: Significance level denoted by * , ** and ****				*p<0.1; **p<0.05; ***p<0.01

Table 63: ESG GOV change (ESG1) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG1 tercile	ESG1 quartile	ESG1 quintile	ESG1 decile
	(1)	(2)	(3)	(4)
MKT	−0.2770	−0.2697	−0.2708	−0.2853
	t = −9.02***	t = −7.92***	t = −7.13***	t = −6.97***
SMB	0.1582	0.1680	0.1827	0.1945
	t = 1.95*	t = 1.86*	t = 1.82*	t = 1.79*
HML	0.0769	0.1082	0.1121	0.0422
	t = 1.00	t = 1.27	t = 1.18	t = 0.41
UMD	−0.0232	0.0008	0.0073	−0.0318
	t = −0.66	t = 0.02	t = 0.17	t = −0.68
Constant	0.0013	0.0013	0.0011	0.0014
	t = 1.05	t = 0.99	t = 0.74	t = 0.87
Observations	210	210	210	210
R^2	0.3110	0.2690	0.2329	0.2100
Adjusted R^2	0.2975	0.2547	0.2180	0.1946
Residual Std. Error (df = 205)	0.0169	0.0188	0.0210	0.0226
F Statistic (df = 4; 205)	23.1303***	18.8566***	15.5644***	13.6213***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 64: ESG GOV level (ESG2) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG2 tercile	ESG2 quartile	ESG2 quintile	ESG2 decile
	(1)	(2)	(3)	(4)
MKT	−0.2524	−0.2461	−0.2324	−0.2296
	t = −5.79***	t = −5.11***	t = −4.50***	t = −3.60***
SMB	0.0595	0.0464	0.0054	0.0339
	t = 0.52	t = 0.36	t = 0.04	t = 0.20
HML	0.0891	0.0916	0.0686	−0.0242
	t = 0.82	t = 0.76	t = 0.53	t = −0.15
UMD	0.0059	−0.0042	−0.0142	−0.0496
	t = 0.12	t = −0.08	t = −0.24	t = −0.68
Constant	0.0020	0.0024	0.0029	0.0039
	t = 1.18	t = 1.24	t = 1.41	t = 1.55
Observations	210	210	210	210
R^2	0.1693	0.1342	0.1067	0.0658
Adjusted R^2	0.1531	0.1173	0.0892	0.0476
Residual Std. Error (df = 205)	0.0241	0.0266	0.0285	0.0352
F Statistic (df = 4; 205)	10.4461***	7.9445***	6.1185***	3.6126***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 65: ESG GOV change accounting for level (ESG3) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG3 tercile	ESG3 quartile	ESG3 quintile	ESG3 decile
	(1)	(2)	(3)	(4)
MKT	−0.2727	−0.2694	−0.2713	−0.2853
	t = −8.22***	t = −7.91***	t = −7.14***	t = −6.97***
SMB	0.1383	0.1544	0.1853	0.1945
	t = 1.57	t = 1.71*	t = 1.84*	t = 1.79*
HML	0.1075	0.1179	0.1191	0.0422
	t = 1.30	t = 1.38	t = 1.25	t = 0.41
UMD	−0.0048	−0.0004	0.0069	−0.0318
	t = −0.13	t = −0.01	t = 0.16	t = −0.68
Constant	0.0014	0.0013	0.0011	0.0014
	t = 1.04	t = 0.96	t = 0.71	t = 0.87
Observations	210	210	210	210
R^2	0.2815	0.2681	0.2333	0.2100
Adjusted R^2	0.2675	0.2538	0.2184	0.1946
Residual Std. Error (df = 205)	0.0183	0.0188	0.0210	0.0226
F Statistic (df = 4; 205)	20.0837***	18.7727***	15.5974***	13.6213***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 66: ESG GOV level accounting for change (ESG4) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG4 tercile	ESG4 quartile	ESG4 quintile	ESG4 decile
	(1)	(2)	(3)	(4)
MKT	−0.2719	−0.2499	−0.2351	−0.2296
	t = −6.00***	t = −5.12***	t = −4.57***	t = −3.60***
SMB	0.0784	0.0575	−0.0010	0.0339
	t = 0.65	t = 0.44	t = −0.01	t = 0.20
HML	0.1368	0.1015	0.0728	−0.0242
	t = 1.21	t = 0.83	t = 0.57	t = −0.15
UMD	−0.0010	−0.0039	−0.0155	−0.0496
	t = −0.02	t = −0.07	t = −0.26	t = −0.68
Constant	0.0025	0.0025	0.0029	0.0039
	t = 1.37	t = 1.31	t = 1.43	t = 1.55
Observations	210	210	210	210
R^2	0.1758	0.1343	0.1095	0.0658
Adjusted R^2	0.1597	0.1174	0.0921	0.0476
Residual Std. Error (df = 205)	0.0250	0.0269	0.0284	0.0352
F Statistic (df = 4; 205)	10.9286***	7.9524***	6.3001***	3.6126***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01

Table 67: ESG GOV change and level combined (ESG5) Factor returns

	Dependent variable: Monthly excess return from Factor portfolio			
	ESG5 tercile	ESG5 quartile	ESG5 quintile	ESG5 decile
	(1)	(2)	(3)	(4)
MKT	−0.2758	−0.2717	−0.2690	−0.2651
	t = −7.96***	t = −7.43***	t = −7.03***	t = −6.44***
SMB	0.1189	0.1324	0.1336	0.1261
	t = 1.30	t = 1.37	t = 1.32	t = 1.16
HML	0.1272	0.1403	0.1301	0.0504
	t = 1.47	t = 1.53	t = 1.36	t = 0.49
UMD	−0.0088	−0.0012	−0.0028	−0.0269
	t = −0.22	t = −0.03	t = −0.06	t = −0.57
Constant	0.0018	0.0019	0.0020	0.0022
	t = 1.32	t = 1.32	t = 1.31	t = 1.37
Observations	210	210	210	210
R^2	0.2674	0.2446	0.2232	0.1862
Adjusted R^2	0.2531	0.2298	0.2081	0.1703
Residual Std. Error (df = 205)	0.0191	0.0202	0.0211	0.0227
F Statistic (df = 4; 205)	18.7035***	16.5924***	14.7273***	11.7264***

*Note: Significance level denoted by * , ** and ****

*p<0.1; **p<0.05; ***p<0.01